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WORLD CROPS

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The International Journal of Agriculture

VOLUME 11, No. 4 APRIL 1959

A Publication of The Leonard Hill Technical Group

The debut of the David Brown '950' A two-furrow deep-digger plough making a 12-inch furrow 14 inches wide in hard frozen ground, with the editor at the wheel

Noxious insects, fungus diseases, weeds, vermin

have through the centuries incessantly continued to inflict devastating damage to agricultural crops, to reduce harvest yields, to destroy foods and materials, and to endanger the health and lives of mankind and animals; all too often peoples perished and cultures were exterminated due to plagues of pests, and until recent times man was powerless against these parasites.

The economic damage caused in the past by fungi, insects, weeds and pantry pests cannot be expressed in figures. Estimates have revealed that the value of the damage inflicted annually in the U. S. A. is so high that it would suffice to feed 50 million more people than is otherwise the case. In Germany, the yearly losses of cereals, root crops, vegetables fruit and grape vines amount to 7.8%.

The necessity of constantly increasing food supplies can be met by two possibilities, firstly to expand the acreage for agriculture, and secondly to increase and safeguard the harvest yield per unit of area. The first possibility can hardly be utilized any further in many cases so that the only alternative is to increase and safeguard the harvest yields.

Crop protection as a factor for increasing and safeguarding yields assists the farmer to reap those harvests which he should realise from the use of high-quality seed, application of cultivation practices and fertilizers. Crop protection and pest control are essential for guaranteeing supplies of food sufficient to satisfy the needs of people throughout the world; today these measures constitute a task of national economy and have attained world-wide, international importance, but for the individual farmer they are a top-ranking problem of farm management.

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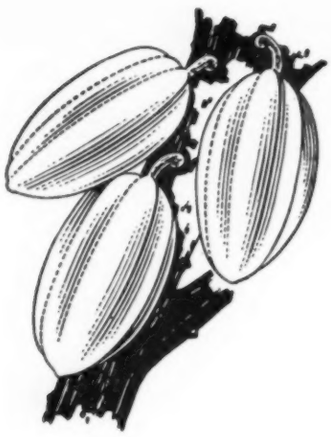

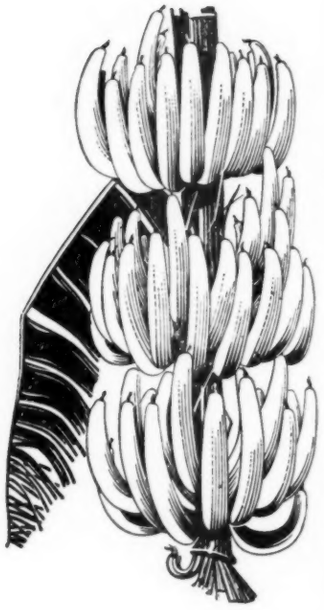

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Editorial Comment

Crop Protection and Pest Control Exhibition

THE *Second Crop Protection and Pest Control Exhibition* is to be held in the Seymour Hall, near Marble Arch, London, in the same week as the world-famous Smithfield Show. Sponsored by WORLD CROPS and backed by the resources of the Leonard Hill Technical Group, the Exhibition is bound to attract a host of visitors.

The Exhibition will be supported by an intensive publicity campaign to attract farmers, foresters, planters, market gardeners, horticulturists, amateur gardeners, port inspectors, public health officials, and, of course, all those engaged in research and the administration of agriculture, not only in Britain but also in other countries. The Exhibition will therefore provide an ideal medium for the display and sale of insecticides, acaricides, nematocides, seed dressings, poison bands, fumigants, fungicides, poisons and weed-killers; of flame guns, protective netting, electric fencing, traps, alarms, repellants, attractants, and glass and plastic cloches; of machinery and equipment, such as sprayers, dusters and injectors of various types—hand-operated, knapsack, portable two-man, wheeled, tractor-drawn or tractor-mounted; and of various protective services using helicopters or fixed-wing aeroplanes.

Further information may be obtained from: The Exhibition Manager, Crop Protection and Pest Control Exhibition, Leonard Hill House, Eden Street, London, N.W.1. Telephone: EUSton 5911; Cables: 'Lenardil, London.'

The rival world

THERE IS an enormous preventable waste of the world's food supplies owing to the damage and depredations caused by animals, birds, vermin, insects, mites, slugs, snails, eelworms, plant fungi and hostile soil organisms. These constitute the 'Rival World' in that they directly or indirectly compete with Man in the struggle for existence. To all these forms of life, food is food and it is of no consequence to them that if they eat well, we may not eat at all. In addition, there are the unproductive plants, described as 'weeds,' which compete with food and other crops for the available supplies of plant foods in the soil.

For the first time in the long history of our planet, Man is turning the tide in the never-ending war against this 'Rival World,' so making it possible to provide food for the ever-increasing population and to compensate for the loss of arable lands and pastures caused by the steady expansion of towns and cities, and the use of fertile flatlands for the making of broad new motorways and vast new airports. The scientists who have developed the new plant-protection chemicals, and the engineers who have produced the ingenious machines and special equipment to apply them, have in a little more than 10 years brought about a revolution of far-reaching consequences to mankind.

It is still sometimes objected that such operations are contrary to Nature, but all forms of agriculture, horticulture and forestry represent an interference with the free processes of Nature. The new science of crop protection and pest control is in fact part of the never-ending struggle for existence. which Man has waged with the 'Rival World' since the dawn of time.

The value of silage

IT IS sometimes worth bearing in mind that the quality of the food eaten by animals used as a source of meat or dairy products has a direct relation to the quality of the food which we obtain from them. Some of the work carried out in the field of cheese technology has been concerned with the effect of grass silage on the ripening of cheese. Because of the recent wet summer in the U.K., it is not surprising that hay and silage analyses show high moisture, high fibre, and low protein and starch contents; the composition of supplementary compounded feeding-stuffs should therefore, in theory, be determined on the basis of these analyses. The suppliers of the compounded foods can hardly be expected to supply just the right kind of food which will make good the deficiencies in natural food if these deficiencies have not been indicated. Analytical work of this nature is readily carried out by the National Agricultural Advisory Service, and also by many well-equipped commercial laboratories who willingly help when the facilities of the former are taxed to capacity.

It is increasingly coming to be realised that the application of scientific knowledge to animal feeding not only enables the producer to be less dependent on the vagaries of our climate but is economically sound. A striking example, described recently in *The Times*, is the case of a pig farm in Gloucestershire where an extraordinary steadiness of output and uniformity of quality has been achieved by controlled feeding and by the systematic elimination of disease. The state of affairs is almost factory-like, with precision planning, accurate prediction of future output, maximum use of accommodation, use of

labour and materials, and a routine that can be worked throughout the year. Naturally, such a system is not capable of universal application, but there is plenty of scope everywhere for improvement along such lines, with considerable benefit both to the livestock farmer's pocket and to the consumer.

New silage making process

A FEW years ago a Dutch factory of feedingstuffs carried out extensive research into silage making methods. This work is now so far advanced, and the results obtained are so promising, that it would seem advisable to tell our readers something about this technique.

It has been known for some time that it is not absolutely necessary to add such auxiliary agents as acids and molasses. The greenfodders themselves contain sufficient quantities of easily fermentable material, which is not always immediately available in the fresh product; this may slow down and sometimes affect fermentation. If these fermentable constituents are exposed by means of a mechanical treatment, or if the material is crushed in such a way that a large number of cells are opened and the emerging juice can spread over the entire surface of the mass, we may be sure of rapid fermentation.

Thorough crushing is also accompanied by a reduction in volume, the advantage being that the mass, so reduced, is very compact, encloses little air, and is not easily accessible to the outer air. In order to reduce the losses through drainage, the new Dutch method prescribes the addition of a dry feedingstuff with marked water-binding properties to the fresh greenfodder.

The crushing and reduction machinery developed for the method described above has a capacity of from 3 to 5 tons an hour with a power consumption of from 15 to 20 h.p. The capacity will, of course, increase, and the power consumption decrease when the machine is adjusted to lighter crushing. It would appear that the correct degree of crushing has yet to be determined.

Eat more grass

IN THE *Journal of the Royal Arts Society*, June 1958, details are given of a lecture delivered by N. W. Pirie, Head of the Biochemistry Department, Rothamsted, discussing 'World Hunger as a Biological Problem.' The circumvention of waste is considered and, in this connection, the inefficient use by the cow of its pasture is cited. Grass may be fractionated into its components by pulping and coagulation. In this way, proteins, fats and starches can be separated as a food for man, amino-acids, sugars and salts can be coagulated and used as a medium for the growth of micro-organisms, whilst the fibrous residue can still be used as a fodder for ruminants and a substrate for microbial fermentation. The lecturer brought leaf proteins in various forms—biscuits, ravioli, cromeskis and solvent extracted powder, and urged interested members of the audience to sample them after the meeting.

The use of grass as a human food is not as far-fetched as it may appear. It may not be generally known that when pellagra, due to vitamin B_2 deficiency, threatened death and permanent blindness to many thousands of prisoners of war in Singapore, the large-scale production of grass juice from Lallang, *Imperata cylindrica*, was organised. Its revolting smell was modified with a touch of chloroform and after some understandable initial reluctance, this unnatural food came into such high demand as to exceed the productive capacity of the grass factory. Approximately one-half of the prisoners consumed a pint a day with, not exactly pleasure, but certainly with avidity. The result was that the eyesight of the Singapore prisoners was better than that of the inmates of any of the prison camps in the Far East, according to an inspecting surgeon at a military hospital in London.

On writing

DEAR READER, Do you want to write for WORLD CROPS? If so, an article of from 1,000 to 2,500 words, a news item of world interest, a comment on agricultural matters, or even a contentious letter is acceptable for publication, providing the material is based on first-hand knowledge or experience, is of sufficient interest to our readers, is carefully prepared and attractively presented; it must be expressed in plain English without the affected use of abstruse terminology and without padding. Photographs or diagrams or drawings are very desirable, but beware of including tables if they are merely uninformative masses of figures. A table should only be included to assist the text.

There are many who have something useful and interesting to write about and don't know how to begin. Providing the principles of grammatical expression are understood, the only way to learn public speaking is to make speeches, and so, too, with writing. When we were at school, our week-end essays were invariably returned with the comment: 'A good effort but do again' and so we learned in those days the hard way. So don't be too disappointed when 'The editor regrets . . .'

To some of our readers, English is a second or third language and they cannot be expected to express themselves in perfect English. Providing the material is good, the editor can correct faulty expression—within reason, providing there are wide margins and ample room is left for corrections. We particularly welcome articles from countries overseas.

There are roughly two types of articles – the factual and the inspired. An idea is born; it may be meditated upon for weeks; observations, investigations, reading

and research may be required; and finally, when conclusions have been reached, comes the execution of the article.

The good writer does not work office hours. The average daily task of creative writing or typing is about four hours a day, but beyond this period the author may be developing his theme in his mind at any time of the night or day. In four hours, he is doing well to produce 2,000 words, and if he does more than this he usually works to exhaustion. Some writers can only find expression when the mood is on them, others work remorselessly to a set daily timetable, *e.g.* 9 a.m. to 1 p.m. It is difficult to lay down hard and fast rules for this intensely individualistic method of self-expression.*

Million-dollar proposal

THE INTERCHANGE between temperate and tropical countries of deep-frozen produce – deep-frozen prepared food, fresh fish slices and baby peas in exchange for deep-frozen pineapple segments, tree-ripe orange slices or diced papaya – offers enormous possibilities in world trade.

It was in 1948 that we first bought deep-frozen pineapple in a multiple, ' help-yourself ' store in San Francisco. The idea was taken to Malaya (where the pineapple industry was being rebuilt following its total destruction during the war) and was put to leading Chinese and European business men; a deep-freezing canning line was installed at the Canning Research Station in Johore – and what has eventuated? – precisely nothing. There is still no deep-frozen pineapple in European shops.

The American product was picked ripe, mechanically processed, carefully selected and rapidly packed, and was perfect. It may not be generally realised that deep-frozen pineapple is superior to the imported whole fruits and to the top-grade canned product, for it is picked dead-ripe, is mechanically peeled, cored, selected and segmented, and the quick deep-freezing process preserves the cellular structure of the tissue without damage, unlike chilling or freezing at or near 32°F.

The whole fruit, on the other hand, has to be picked unripe or slightly unripe, it has to be very carefully handled in the field and packed in individual packings in special crates – so much so that ten times the weight ultimately eaten by the consumer has to be shipped and the loss by spoilage in transit can be enormous. That is why a pine worth, say, a nickel in the West Indies is worth a dollar or more in Europe and is at times unobtainable, whereas the deep-frozen product is never out of season, is cheap to transport, and is ideal for the restaurant trade, since it requires no preparation.

The same applies to a lesser extent to canned slices, but this product involves the needless carriage of water (syrup), of tinplate and of the container (a box or fiberite package).

Deep-frozen pineapple is a segmented product which comes to the consumer in flat cardboard packages, just like frozen peas or sliced beans. The same could be done with orange slices picked – tree-ripe or diced pawpaw of the delicious Hawaiian type – the food of the gods.

So there we have the possibilities of more trade as between East and West, between temperate countries and the hot tropics – peas from London, Rotterdam or Hamburg in exchange for deep-frozen pineapple from Singapore, Brisbane and Jamaica; or frozen orange slices from Haifa, Durban or Barcelona, using the same deep-storage facilities to take back frozen strawberries. The shipping companies need not suffer, because the loss of freight would be made good by the growing two-way trade in deep-frozen products.

The golden goose is dying

ACCORDING TO a report in the *Tea and Rubber Mail* of 9 October, 1958, it would appear that the Ceylon Government is determined to take over all the British-owned tea estates in the Island. The estates concerned make up a total of 202,000 acres out of a total of some 555,000 acres under tea, and they are undoubtedly the best run (and therefore the most desirable) properties. But will they remain so?

Tea-planting in Ceylon has been an amazing success in the face of many difficulties; other crops, such as coffee, have been tried and failed disastrously. In 1875, coffee was the leading crop, but it was wiped out by Coffee Blight, *Hemileia vastatrix*, and the acreage was reduced from 300,000 acres to nil. Then cinchona was tried and it too failed; meanwhile about 1,000 acres of tea were planted and this experiment succeeded.

Most of this planting took place in the inaccessible jungles of the interior which nobody wanted. The early pioneers cut their own roads through leech-infested swamps and malarial jungle, so that their successors can now travel in cushioned comfort; they made their mistakes and they profited by them. It appears, however, that failure must be financed by the pioneer, and success must be handed over, and that at a time when this key industry is at the crossroads.

Most of the industry is now over 60 years old and in need of replacement. This is actually a much more difficult proposition than the original clearing and planting; it is not just a case of supplying new plants for old. It requires re-capitalisation, past experience, new knowledge and above all—vision. Normally, the industry would take this task in its stride, but today confidence is lacking.

* Read ' Writers at Work '. Secker and Warburg, 1958. Obtainable through Technical Books, 308, Euston Road, London, N.W.1

First of all it may be necessary to replan the estate to fit the crop to mechanised operations, to provide new roads and improve the soil and water conservation; it will certainly be necessary to rehabilitate the impoverished soil; and it will also be necessary to replace the existing stand with higher-yielding material. All this is absolutely essential in a highly-competitive market, if the industry is to survive . . . and if it does not what will happen to Ceylon?

Rain-making and the law

THE GROWING ability of meteorological scientists to cause precipitation of rain is bound to have a profound effect upon agriculture in many parts of the world. The process is not without its hazards, however, and recent happenings in Australia have shown that a number of legal niceties may be involved. For this reason the Government is considering the legal aspects of rain-making.

The action follows experiments by radio-physicists of C.S.I.R.O., whose attempts at rain-making have twice within the last year met with dramatic success. In December last they created 20 storms from their planes, each 10 miles across, and produced falls of up to 20 points in two areas of New South Wales. In January three men were nearly drowned and a vehicle was swept away in a flood caused by rain-making experiments in Queensland.

Several legal points arise from these events. What would happen, for instance, if heavy rain fell on the property of a landowner who did not want it, involving him in material losses? Who would have been held responsible if the three men had drowned? Could their relatives have sued the C.S.I.R.O., the Mary Kathleen Uranium Co., which sought the rain-making attempt, the Queensland Government, or the Australian Government? These points were raised by Professor G. Sawer, Professor of Law at the Australian National University, who pointed out that legislation was needed immediately to protect not only the rain-makers, but also those on whose property the rain fell.

Under common law, he said, a landowner owns the ' superincumbent column of air ' rising above his land to the limits of the atmosphere. The Australian Government has made statutory exception to the private ownership of air to prevent action for trespass being made against airlines, but they have been held to be liable for anything falling from a plane and causing damage. Therefore the assumption is that if a rain-maker caused rain to fall which damaged a farmer's property he would be liable.

' Old Buttercup be off her feed, Zur '

Taint in coffee

WITH REGARD to the editorial comment on the above in WORLD CROPS (1958, **10**, 392), we have received the following interesting remarks from a correspondent:

> You may be interested to hear that we have had several instances of taints occurring in coffee liquors following the use of certain chemicals. So far, BHC and PCP have definitely produced taints and there has recently been some evidence to suggest that CMPP may also introduce an off-flavour into the coffee liquor.
>
> For further details I would refer your readers to a short notice by R. W. Rayner entitled ' Bricky Flavour ', which was published in the monthly Bulletin of the Coffee Board of Kenya of April 1951, page 90, and a report on ' Herbicides ' in Kenya, which appeared in the Pesticides Abstracts and New Summary, Sec. C, 4, July 1958.

What next?

WE LEARN that a pilot scheme for ' battery beef ' production is to be tried this summer or autumn at the Harper Adams Agricultural College at Newport, Shropshire. Mr. R. G. Mortimer, of the College, has spent 18 months studying beef production in the U.S.A., where there are units fattening 50,000 cattle a year.

The experiments at Harper Adams will be only on a modest scale. It is intended to use Herefords or their crosses and a start will be made with 30 or 40 cattle. An important item of their diet will be green maize silage.

The capital required for a large farm will be £5,000 to £10,000 with a yearly production from each unit of 100 to 1,000 cattle.

The big advantage of this system is that cattle will be ' kept going ' all the time, and so avoiding fluctuations in liveweight gain which occurs when animals are left for grazing. The idea is that eventually all feeding operations will be controlled by time switches.

The Importance of Silage

Once stall-fed cattle were dependent on poor-quality hays, straws and other roughages for their winter feed, which left them weak and emaciated. Well-prepared grass silage now offers a cheaper and better substitute.

IT is only recently that silage has been recognised as an essential part of good farming and grassland management. Silage is made because it provides a cheap food for livestock during the winter. Its making is less dependent on weather conditions than haymaking, and grass can therefore be more easily conserved when it is still leafy and capable of giving high feeding value. Full use of surplus grass can be made and silage-making will reduce wastage caused by the continuous grazing of pastures.

Silage-making can fit in with any farming system and should start with a well-grown crop which should be ensiled at the correct stage of growth.

Stock self-feeding at the face of a 'Silotex' clamp. They have 9 in. of silage per head and access for 24 hours per day

Quality of grass

The best silage comes from grass which has been well-manured giving it a heavy crop of leafy herbage. A grass which is stemmy with little leaf will not make good silage. It is important that the time of cutting the grass is chosen carefully, and if the grass is cut late in growth, when the seeds heads have appeared, it will give less nutriment to livestock. The optimum stage for cutting the grass is while the crop is still leafy.

The grass should be dry when ensiled so that there will be no nutriment loss through seepage. It has been estimated that silage which is allowed to heat up to a temperature of 90° – 110°F. is better preserved than silage which has a lower temperature.

On the other hand, high temperatures in silage over a period of time will result in low food value. If the temperature rises above 110°F. the silage should be heavily consolidated, or pressed together.

Short and leafy grass has a high moisture content which will prevent it from heating up too much, but the filling of the silo should be so regulated that there is some rise in temperature in the whole mass of ensiled grass.

It is the carbohydrate content of the grass which encourages the necessary fermentation which in turn forms acids preserving the silage. A crop cut after the seeds heads have emerged will probably have sufficient carbohydrate in it for preservation, but will be poor in nutritional value. However, good leafy grass is normally deficient in carbohydrate and has high moisture content which hinders effective fermentation. The same applies to a grass crop, containing a lot of lucerne or clover, which makes it difficult to make into good silage.

Use of additives

In order to overcome these difficulties, the silage needs to be treated in some way to get a better result. The following methods are commonly practised. Firstly, molasses can be added to stimulate fermentation. About $1\frac{1}{2}$ – 2 gal. of molasses, diluted with an equal volume of water, are added to each ton of grass. If the crop is very lush or if pure lucerne or clover is being used, the amount of molasses added should be increased.

A second method is to add sodium metabisulphite,* which acts in a different way. This chemical acts as a sterilising agent, and unlike molasses does not stimulate fermentation but reduces the activity of the bacteria in the silage. This has the added advantage of eliminating the usual unpleasant smell. Metabisulphite comes in the form of a fine powder and, when applied, care should be taken to ensure that it is mixed intimately with the whole of the mass. It is also advisable to lacerate or chop the crop to assist consolidation.

Metabisulphite is best applied by means of an applicator on a forage harvester to introduce the powder in a continuous flow. For each ton of silage, 9 – 10 lb. of metabisulphite is enough, although 11 – 12 lb. is recommended when it is applied by hand – a difficult and tedious process. Consolidation to keep the silage at a fairly low temperature is advised, when using this chemical.

Reducing the grass crop to a dry matter content of about 30% by

* Sodium metabisulphite is sold under the trade name of 'Silotex' by the Shell Chemical Company

A covered pre-fabricated concrete silo

wilting has given good results on most types of leafage. The seepage from the silage is greatly reduced with no consequent loss of nutriments, and the silage is well preserved. Heating will easily take place and it will probably be necessary to consolidate. This means that the use of this method with mature crops with plenty of stem is not recommended. About six hours' wilting during the day will be necessary in fairly good weather, but this should be modified according to weather conditions and the stage of crop growth.

Crop laceration

The fourth method of silage-making is by laceration or chopping of the grass, with a forage harvester. Bruising during harvesting helps fermentation and thus stimulates the formation of the preserving acids. If the grass is young, or contains much lucerne or clover, this method may not produce perfect silage though it is better preserved than if it had been left in the silo for a long time. For these crops, it is usually advisable to assist fermentation in addition to bruising.

This method has the great advantage of making the grass easy to consolidate and the temperature of the silo is better controlled. Also the grass can be packed to reduce losses at the sides and top of the silo, due to air getting at the silage.

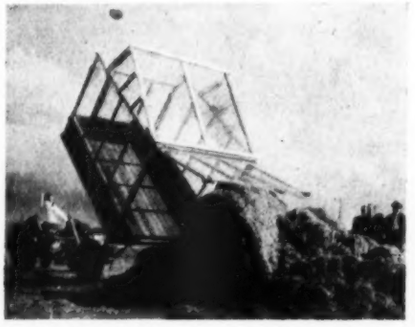
Air-sealing

Once the grass is ensiled, it must be protected until it is needed for feeding to livestock by keeping out air and water. On the more exposed parts of the silo, the side and top, wastage could occur due to the production of moulds and bacteria from the effect of the air on the grass.

A trench type of silo will check side wastage provided the silage is tightly packed and the walls are smooth and clean, preventing air pockets from forming. Where possible really firm side walls should be constructed so that the tractor-driver will have enough confidence to pack the silage tightly up against the sides. Drainage with this type of silo is essential to prevent water-logging.

Where the silo is a stack or a clamp silo with no sides even more wastage is likely to occur, and in this case the pile of silage should be made as large as possible, so that the proportion of bad silage to good is small.

To eliminate surface wastage, a seal can be put over the top of the silo to prevent air entering. Among materials which can be used for such seals are soil, ground chalk, or ground limestone. The seal should be fairly deep, about 4 in. – 6 in., and should be applied the moment the silo has been filled and after the silage has been well rolled. The seal should be pressed firm at fortnightly intervals.



An hydraulically-operated tipping trailer depositing its load at the edge of the silage pit

Clamps and silos

The selection of silos is another consideration in making successful silage and to a certain extent this depends on deciding capacity and the amount of silage that will be needed. With an open-sided clamp, the size can be modified while it is being filled. The clamp silo should start by being small, since it is essential to have a good depth of settled silage – at least 4 ft. For other types of silo, about 2 cu. ft. should be allowed for each ton of finished silage.

The clamp and stack type of silo have the advantage of involving no special construction time and costs, also they can be put on any convenient site. There is no drainage problem and any seepage can flow easily away from the base of the silo. Where the farm is on heavy land, with a high water table, these types of silo are better than the trench type. On the other hand, the lack of walls means loss of silage by air getting at the sides. To minimise this, the stack should be as large as possible so that the proportion of waste to good silage is as relatively small as possible. Additional consolidation can be effected by tractor and trampling. Fast filling to prevent overheating is essential.

An above-ground silo with side walls is growing in popularity. Here, there is little drainage problem, provided it is well sited, but the site cannot be so easily changed as in the case of the clamp or open silo. Any convenient and cheap material can be used provided it is strong enough

A forage harvester picking up from the swathe

to support the weight of the grass and a tractor, suggested materials of construction are soil, concrete and railway sleepers. If the side walls are sloped then consolidation will be facilitated. High walls make working conditions safer and are suitable with roofed, but not with unroofed silos because rain will get between the silage and the walls.

The Dutch Barn has been described as the most ideal silo, for in such a construction the silage is protected from the weather at all times. Where excavation is possible, it can also be partly a trench silo, so greatly increasing capacity, although drainage will have to be included. Farmers consider the cost of a Dutch Barn rather high, but if the space over the silage is used for storing hay or another material, then the cost is more economical.

A green crop loader picks up grass from the swathe

If the soil has good drainage, the trench or pit silo provides a fairly cheap way of storing silage. If the silage is carted out during the winter months it may be difficult with such a silo unless a concrete floor has been laid, which makes the self-feeding rather unsuitable. In such a silo, the depth is important and where it is not possible to have a very deep trench, the excavated earth can be banked up on either side of the trench to give extra depth. Again the keeping of the silo sides cleaned and smooth should be stressed to eliminate side wastage. The level of the settled silage should be slightly above that of the sides of the silo so that the rain-water can run off.

In most types of silo a lead-in ramp at one end is necessary. This makes downhill unloading possible when it is an above-ground silo that is being filled, and the capacity of the silo will also be increased. A removable ramp can be constructed out of railway sleepers and used for a number of silos.

Harvesting grass

At the National Silage Demonstration in Britain last year, the enormous variety of machinery shown gave the farmer plenty of choice in selecting his method of harvesting grass for silage. There are four methods: by the use of a buckrake, a forage harvester, a pick-up baler or a green crop loader. The buckrake is probably the cheapest and can be used when the handling distance is short. Of simple construction, the buckrake can be used on any type of farm and with any labour.

The forage harvester has a beneficial bruising effect on the grass when it is harvested, which helps in the fermentation process. Consolidation is easier with chopped grass and this in turn reduces wastage. The forage harvester is expensive, however, and modified trailers are needed for carting the grass.

With a small labour force and over long haulage distances, the pick-up baler has its advantages. Bales properly stacked in the silo can easily be removed for feeding and an estimation of the quantity of silage being fed is possible. Most crops need some treatment when ensiled and this is difficult with the baling system. The green crop loader can be used when long hauls are involved

A continuous pick-up baler seen in operation

though this method is often wasteful of labour.

In choosing the most suitable method of harvesting, the farmer should consider whether the high capital outlay involved in buying a machine is balanced by the amount of silage he will produce. A buckrake or baler, which may be already available on the farm, is probably the most economically attractive method to most farmers making a small quantity of silage.

Quality of silage

In order to estimate the feeding value of the finished crop the farmer must know the following points: the quality of the fermentation, and of the crop ensiled and how much moisture the silage contains. The three main types of fermentation can be estimated from the following distinctive characteristics, obtained from Dr. J. C. Murdoch's excellent booklet on silage-making:

Well fermented silage

Colour: Bright. Light green-yellow; green-brown; khaki.
Smell: Pleasant; vinegary; fruity.
Taste: Sharply acid.
Texture: Firm, soft tissue, not easily rubbed away from leaf.

Badly fermented silage:

Cause: Underheating or water getting into the silo.
Colour: Dull. Olive green; blue-green; drab brown.
Smell: Strong. Offensive and clinging; rancid; stale.
Taste: Insipid or offensive.
Texture: Slimy, soft tissue easily rubbed from fibre of leaf.

Overheated silage

Cause: High temperatures in the silage.
Colour: Brown; black when very seriously overheated.

Smell: Burnt sugar or tobacco-like.

Texture: Friable and dry.

Black mouldy silage, which is slimy and foul smelling should not be fed to stock.

Feeding silage

When feeding silage to cattle, wastage and costs should be kept as low as possible. To do this, double handling of the silage should be avoided and appropriate vehicles for carting should be used. Three main ways of doing this are by hand-loading a trailer, or a hand truck, if the silo is near the feeding place, or if the silage is cut into convenient blocks, a fore-end loader can be used.

It is a common practice to stall-feed animals in a cowshed or in yards, and this allows individual feeding and a low amount of wastage, although the labour used is high. In some cases where the feeding passage is wide enough, the silage can be thrown into the troughs from the trailer, but individual feeding is thus eliminated.

In the field, where the stock is wintered outdoors the silage can be spread on the ground near the animals. Wastage can occur here if too much is carted out or if some of it gets trampled upon. The silage can be placed in a long trough alongside the silo, especially where the silo is a clamp or stack type.

Self-feeding can save time and labour, as no handling of the silage is necessary – an unpopular task on account of its unpleasant smell and weight. If there is a fence in front of the silo, the animals will be prevented from trampling in any silage accidentally dropped on the ground and a concrete floor on the silo is strongly advised to prevent too much mud from forming.

Silage of uneven quality is not suitable for self-feeding and will cause wastage since the cattle will leave the more unpalatable layers, making controlled feeding impossible. At least 6 ft. of settled silage is necessary for this to be successful. Less than this will make the silage loosely packed and therefore easy for an animal to pull out quickly. More than 6 ft. makes it too tightly and heavily packed for the animals to get enough to eat.

Self-feeding is more likely to be successful if the cattle are polled or dehorned. Generally 6 – 8 in. of silage face should be allowed for each animal and the conditions around the silo should not be such that the animals are encouraged to stay there and eat too much. If a limited time is allowed for self-feeding the size of the face should be increased to about 18 in. per animal so that most of the animals can feed simultaneously. A well littered, covered yard nearby will encourage animals to move away from the silo face.

A New Holland baling machine at the National Silage Demonstration

The successful silage-maker has to know the type of silage he wants, grow the grass crop well, cut it at the right time, judge the amount of silage needed and plan the silos accordingly. The silage-making should fit easily into the general farming system; silage-making is less dependent on weather conditions than hay, but the farmer will not get the best out of silage if he makes it a haphazard affair, left very much to chance.

Photographs taken at the National Silage Demonstation, organised by the Shell Chemical Company, in collaboration with the Ministry of Agriculture, the National Institute for Research in Dairying, the N.F.U., the Milk Marketing Board, and the National Institute of Agricultural Engineering.

Cocoa

The First FAO Technical Cacao Meeting, held at Accra, Ghana, was attended by representatives from 21 producing and consuming countries, by observers from a number of large cacao-processing firms and by representatives of such international organisations as the Inter-American Institute for Agricultural Science and the South Pacific Commission, and from such research institutions as the Institut National pour l'Etude Agronomique au Congo Belge, the American Cacao Research Institute and the Institut du Cafe et du Cacao de France. It was organised by FAO in co-operation with the Commission for Technical Co-operation for Africa South of the Sahara and the Scientific Council for Africa South of the Sahara.

The meeting discussed reports from eminent cocoa specialists on such technical subjects as the rehabilitation of old plantations, methods of selection and breeding, nutrition, water and shade requirements, cocoa pests and diseases, fermentation and drying of cocoa, and extension work.

The conference recommended that the Organisation should (1) organise expeditions in countries where promising plant-breeding material is likely to be found, (2) establish regional disease-free cocoa collections which would distribute plant material, (3) establish regional plant quarantine stations, (4) establish a centre for basic research on black pod disease, (5) help expand research on basic physiological problems of cocoa production, (6) prepare publications on cocoa, (7) grant fellowships to research workers and (8) establish training centres in producing areas in Africa.

Basic Factors in Herbage Production

The Winter Meeting of the British Grassland Society

Mr. F. R. Horne, C.B.E., President of the British Grassland Society

' Our duty as scientists and technicians is to labour with a view to making the grass ley foolproof in all respects, and in all places, as a safe and nutritious feed for animals at all times; and as a thriving crop under all circumstances – foolproof alike on the poor lands and the fat lands '.

Sir George Stapledon, June 1945.

IN opening the Winter Session of the British Grassland Society, the President, Mr. F. R. Horne (*Director of the National Institute of Agricultural Botany*), indicated some of the ways in which progress can be made in the development and use of better seeds and better ' cultivators ' or varieties of herbage and pasture grasses. He revealed that under the new Seeds Act – now under consideration – the variety would have to be stated whenever seed is sold and not merely the common plant name, *e.g.* lucerne.

He said that, from an ecological standpoint, grassland might fairly be described as vegetation which was preserved when the pressure of grazing by animals was too great to allow trees and shrubs to colonise the area, but too little to remove the plant cover altogether.

There were, he said, different grasslands on each of the four main soil types – chalk, peat, clay and sand; and these are further modified by altitude, rainfall and pressure of grazing.

But not only did the species differ; within each species there was a range of types with important inherited differences.

Wealth of genetic material

The N.I.A.B., in co-operation with the Grassland Research Institute, had been making a study of the principal bred and local varieties which have so far been developed in Europe and it was his impression that a great wealth of genetic material in this country and throughout Europe was so far untapped.

Ecotypes or local varieties might differ in palatability and in nutritive value. Thus lucerne growing in the U.K. had already benefited immensely from the ecotypes imported from Flanders. But it was not until after the Second World War that these early-flowering types were widely used, though the unique value of the Flamande type of lucerne for high production had been recognised in France for a very long time.

In Spain there was an immense range of ecotypes of lucerne growing under widely different conditions of soil and climate. So far, he said, these have never been studied. In view of the need for lucerne varieties capable of persisting under close grazing and for varieties resistant to verticillium wilt, further exploration of the native lucernes in appropriate areas seemed to be well worth while.

When ecotypes or other varieties are moved into new areas or subjected to different conditions of management interesting changes occur. The OEEC grass and clover test plots organised throughout Europe by the G.R.I. and the N.I.A.B. carried identical control varieties in the different countries.

Quite a lot of deaths had occurred in nearly all the varieties grown, and he wondered which type of S.48, timothy or Cotswold red clover would be left at the end of the two or three years of the trials in Finland, Portugal and Greece. It was most unlikely to be the same fraction of the variety which is left in these different regions. The residues might almost be regarded as new ecotypes in the making.

These aspects are intensely interesting, for it was doubtful if there was any greater asset in grassland husbandry than the small minority of herbage varieties which were capable of high adaptability to different environments and systems of management.

New breeding techniques

New breeding techniques, such as the production of polyploids, X-ray mutants and, especially, disease testing offered great opportunities in the handling of the ecotype material. The combination of ecotype studies and breeding for resistance had produced some of the best clover varieties in the world.

As another approach, hybrid vigour was an attractive feature in herbage plants, especially with the short-term leys required for strip grazing and silage. Clausen had shown that from crosses between two ecotypes of *Achillea* the F_1 combined the drought resistance of one with the frost resistance of the other. Thus the hybrid was able to survive the droughts of summer and the severe cold in winter, so that it had a much wider range of adaptability than either parent. He also showed that the second generation or F_2 did not diminish in vigour, as did hybrid maize, but actually increased.

In certain areas there was a tendency to lengthen grass leys, in many cases up to 10 or 15 years. This tendency, if it developed, would, of course, make much greater calls on the inherited qualities of the herbage varieties.

Creep grazing. The lambs on the left are grazing on a fresh pasture and are separated from the ewes which are unable to pass through the creep

The plant breeders' reputation was, he considered, very much in the hands of the seed grower, who could vastly change the composition of the variety by repeated multiplication under ley conditions, not to mention the still greater danger of getting the seed mixed with varieties which do not suit the same purpose at all.

Seed certification

The most important step was to provide properly tested basic seed from the breeder which will not change its character if properly multiplied for one generation in suitable localities. To this were to be added further checks in the seed crop and in the seed warehouse. Seed certification was, he said, no substitute for breeding new and valuable types. It did, however, provide a means of ensuring that the farmer got the variety he wanted.

The progress made in Britain and in some other countries provided the basis, three years ago, for an International Scheme of Seed Certification throughout Europe. This was now being sponsored by the OEEC, after a unanimous vote in their Council, and seed would be obtainable in the international trade from 1959 onwards, produced with all the essential safeguards, which he considered was a very big step forward.

The environment could modify, tremendously, the expression of any genetic character. High or low nitrogen, the time of resting and defoliation, the appetite at that moment of the livestock grazing the sward are obvious modifying factors. However, he believed there was a greater danger in over-stressing the difficulties of handling new varieties than in overconfidence. In the Aberystwyth, Scottish and local sources there were many of the very best varieties of grasses and clovers available anywhere in the world and it was not surprising that some of these were already finding uses in countries overseas.

In conclusion, he said he did not believe there was any real antagonism between the wider interests of genetics and those of practical agronomy. They were complementary the one to the other. With a better knowledge of grassland agronomy, breeding work and the utilisation of the best of the local varieties would be greatly reinforced.

Sideways Creep-Grazing for Intensive Lamb Production *by C. R. W. Spedding and R. V. Large (Grassland Research Institute)*

In intensive lamb production at pasture the two most important problems are (*a*) provision, at all times, of adequate nutrition and (*b*) control of worm infestation. To investigate these problems a comparison of rotational grazing (R) and folding with sideways creep-grazing for the lambs (S) was carried out on ryegrass/white clover swards.

The stocking rate was seven ewes and 12 lambs (Suffolk × Halfbred) per acre from birth of the lamb until all lambs were sent for slaughter. Total fertiliser input was of the order of 3 cwt. complete and 5 cwt. nitro-chalk per acre. A concentrate ration was fed to the ewes for a few weeks after lambing.

The folding + sideways creep-grazing management produced heavier lambs and more meat per acre than rotational grazing at the same stocking rate. A higher quality of meat also resulted. (See Tables I and II.)

Egg counts indicated heavier worm infestation in group R lambs and estimations of infective larvae on the herbage showed much higher counts on R paddocks than either the lamb or ewe areas in treatment S. This suggested that the beneficial effects of the ewe in parasite control were more efficiently exploited in sideways creep-grazing than under a rotational management.

The effect of heavy stocking appeared to be beneficial to the pasture in spite of the very frequent, intensive and numerous defoliations. It suggested that practical application of the sideways creep - grazing technique should begin when the lambs were about one month old.

The More Efficient Grazing of Ewes and Lambs *by G. R. Dickson (Manager, Duke of Norfolk's Estate, Sussex)*

The unsatisfactory status of rotational practices in the intensive grazing management of sheep was reviewed and attributed to several causes.

In recent trials normal rotational grazing was compared with creep-grazing at two levels of fertiliser nitrogen application, the treatments being replicated both on high clover and on grass-dominant swards.

Table 1
The liveweight gains of lamb (lb./acre)

Year	*Creep Grazing*	*Rotational Grazing*
1957	955	870
1958	983	926

The superiority of rotational creep-grazing, suggested by the 1955 findings, was confirmed in the following year. The additional mean gain of 11 lb. per lamb, the 50% reduction in faecal worm egg counts, and the vastly superior condition of the lambs, represented highly significant differences in favour of creep-grazing.

The herbage data revealed that the extension of the defoliation period in creep-grazing caused a slight reduction of pasture growth. The higher nitrogen treatment stimulated herbage production and had a suppressive effect

on the legume fraction of the swards.

The attainment of high levels of production under both experimental and commercial conditions allowed the conclusion that the rotational creep-grazing was capable of high levels of output without sacrificing the quality of fat lamb production frequently associated with more extensive grazing methods.

Disease Factors Limiting Production during Winter and Spring Grazing *by W. T. Rowlands (Min. of Agr. Vet. Service)*

Vagaries of the climate affect both directly the animal itself and indirectly its food supplies. Climatic conditions also influence in no small degree the hazards due to parasitic and insect pests and other disease agents which the environment may harbour. In this sense shelter, natural or artificial, assumed an important role and was particularly vital to the late pregnant ewe and during early lactation.

Table 2
Grade A carcasses

Year	*Creep Grazing*	*Rotational Grazing*
1957	74%	43%
1958	77%	53%

Nutritionally, pasture is never a constant but a variable, and attention to quantity and quality is important at all times, but particularly when there is a seasonal decline in plant growth and food value. The dangers of malnutrition during late pregnancy might precipitate losses from pregnancy toxaemia.

The potential hazards which are associated with early growth of pastures and the physiological upset in the grazing sheep, particularly in peak lactation, are now assuming alarming proportions, so that lambing sickness and grass staggers had become part of the shepherd's vocabulary. With the gradual acquaintance of the sheep with young grass and the provision of adequate shelter against east wind, some of these losses could be prevented.

The hazards due to disease agents at this time could not be divorced from pasture. Foremost among them are the spore-bearing anaerobic germs which are capable of spending a long time in the soil. This large family of organisms are the cause of such well-known diseases as lamb dysentery, pulpy kidney, enterotoxaemia, blackleg, braxy and black disease. The need, where such hazards exist, for the practice of preventive treatment against these diseases is an essential part of sheep management.

Lambs seen passing through a creep on to land which the ewes have not been on. In this way the risk of intestinal worms is reduced

No consideration of spring grazing could omit reference to the liver fluke, which became a greater hazard with intensification of grazing. This hazard was associated with a certain fresh-water snail and wet summers. A recognition of the snail and its possible habitats, drainage, fencing and the chemical destruction of the snail with copper sulphate are all matters demanding attention.

Low Cost Meat from Grass *by J. Bell (Farmer, Barnard Castle, Durham)*

This paper gave a description of the change-over on a dales farm from milk and sheep to beef production and intensive sheep production. Improvement of fertility had produced more and better grass. This increased production was utilised through a breeding stock of ewes producing half-bred (Masham) lambs and a hill-type suckling cow herd producing beef-bred calves. The wether lambs and the beef calves were carried through to a forward or fat stage.

This system on net output compared favourably with other pursuits that could be followed on this type of land and at this altitude, having regard to the low labour requirements and the high net output of labour employed. The capital requirement in buildings was low and the system of farming was simple and had many accumulative advantages.

Sunlight and Coffee

Damage to coffee through lack of sunlight when drying the beans has been proved by the East African I.R.O. as a result of experiments on the mechanical drying of arabica coffee. The organisation's annual report, just issued, describes the work done by J. F. McCloy, using coffee driers fitted with oil-fired heat exchangers. Coffee, already partly sun-dried, was artificially hot and cold dried for 12-hour periods.

The experiments showed no damage in 52 tons dried this way, but after storage for three weeks and finally sun-dried and milled the same samples showed £2,000 worth of damage.

Mr. McCloy then made four identical miniature laboratory tray-driers and did 68 tests to determine the effects of pre-drying the beans in the sun and finishing the drying in the machines. He established conclusively that the damage was reduced by pre-drying and increased by a higher final drying temperature.

He then moved the laboratory driers into the open and found the damage was really caused by lack of sunlight. Later, using fluorescent tubes set close to the drying beans, Mr. McCloy was able to determine the effects of ultra-violet radiation (parchments go yellow), of visible light (bleaching of silver skin and blueness of beans) and of over-heating (sour liquor).

Israel's Wonder Crop —

The Mangel-Wurzel or Mangold

HAIM BAVLY* AND M. BAR-DROMA†
(*Israel*)

The main goal of Israel's agriculture is to raise the greatest possible quantity of food for the people and for the rapidly increasing numbers of livestock – mainly sheep and cattle.

TO increase agricultural production in Israel is extremely difficult because the area of cultivable land is limited and the short rainy season provides inadequate water over the greater part of the country, some regions receiving no more than 8 to 10 in. of rain annually. Apart from this, the country enjoys a very equable climate, for there are no frosts to threaten crops, although low temperatures and heavy rain in certain seasons may cause plant growth to slow down. The growing season is therefore protracted and may, in fact, extend throughout the year. These favourable climatic conditions make it possible to obtain reasonably good yields from a number of crops provided that suitable farming practices are followed and the limited water resources are used to the greatest advantage.

The mangel-wurzel

There is a wide choice of fodder crops suited to these climatic conditions: lucerne, clover, pasture, maize, kale and beans grow well and give reasonably good crops, but of all the forage crops tried the mangold is best suited to Israeli conditions; in fact, there seems to be no other crop whose yield can compete with that of this fodder crop. Top yields (not the average) have reached 180 to 200 tons of roots per acre, obtained by ordinary, but painstaking, farming practice on various types of not especially fertile soil.

It is emphasised that the two factors contributing to these high yields are the longer growing season and an adequate water supply. While the yield is high, the nutritional value of the crop is low, as it consists of 8 to 10% dry matter and 90 to 92% water; therefore the yield in terms of dry matter is about 15 tons per acre.

The Danish 'Sludstrup' and the British 'Lord Warden,' now almost forgotten in Europe, are the two varieties of fodder mangolds grown in Israel. The choice of variety depends entirely on local conditions; the first is the earlier of the two and the second has better keeping quality.

Cultivation

Mangolds may be drilled in the field in the autumn or transplanted in the spring, the higher yields being obtained by autumn sowing. A clover or other legume, which develops a deep root system, has proved a good preparatory crop for fodder beets, but even after a legume, deep tillage and heavy manuring are recommended.

The soil is either ploughed or subsoiled to a depth of 16 to 18 in. and 20 tons per acre of farmyard manure is applied either direct to the beet crop or to the preceding legume. A heavy dressing of fertiliser is considered essential, in the region of 180 to 260 lb. nitrogen per acre, *i.e.* 7½ to 11½ cwt. of sulphate of ammonia or equivalent, half being worked into the seedbed and the remainder applied in two or three top-dressings. Phosphorus and potassium are applied according to the type and needs of the soil. Fertilisers constitute 15% of the total cost of production.

Top yields cannot be obtained without a dense plant population. The usual practice is planting in rows, 22 to 24 in. apart, and 8 to 10 in. in the row. Plant populations per acre, therefore, vary from 27,000 to 32,000 or maybe more. A smaller population, *e.g.* 25,000 per acre, might be sufficient provided that the beets reach an average weight of at least 15 to 17 lb. The field must be maintained in a clean condition; this entails careful initial soil preparation and shallow cultivation from time to time during the growing period.

A giant mangel wurzel grown in Israel

Irrigation

The fodder crops can be grown in Israel without the application of water, which is particularly needed during the period of greatest growth – April to August. The mangold, however, is the most economical of all the forage crops in its requirements. Whereas lucerne needs about 30 to 40 in. of added water, the mangold requires only about 20 in. to be applied.

Much has still to be learned about the method of application. At present overhead irrigation is applied in September before the seed is sown, the soil being saturated to a depth of 2 ft. After planting, a very light irrigation is needed to induce germination. Subsequently, and until the rains start in November–December, one application of water, equal to 2 in. of rain,

(*Continued on page* 137)

*Chief Adviser for Forage Crops.
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Potassium for Pastures

Fertiliser Trials in Australia

G. W. HEXTER, B.AGR.SC.

(*Department of Agriculture, Victoria*)

Marginal scorching and spotting of subterranean clover leaves caused by potash deficiency in the soil

UNTIL recently reports of potassium deficiency in North-Eastern Victoria were rare, and it was assumed that this problem, which had developed in the older improved pasture districts of the south, was unlikely to be of much consequence in the north-east. However, the results of recent trials in the north-east have confirmed suspicions of potassium deficiency. Positive responses have been frequently obtained on trial areas and, as they have not been limited to particular soil types, it has been concluded that, when the pastures and soils of the district are worked beyond certain limits, potassium deficiency may be induced.

Signs of deficiency

Except on poor hungry sands, potassium deficiencies are unusual on virgin soils in Victoria. They occur most frequently on land that has been regularly cropped, or on pastures that have been cut too often for hay or silage. On deficient land, the pastures lack vigour, the clovers are weak or absent, and, as the pasture thins out, weedy grasses and flat weeds become prominent. In the wetter districts, Yorkshire fog grass and sweet vernal often take possession of potassium-deficient pasture land.

Potassium - deficient land usually gives a poor response to top-dressing with superphosphate, and the history of paddocks, deficient in potassium, often reveals that after several years of good response to top-dressing with superphosphate the pasture slowly deteriorates and finally fails to respond satisfactorily to dressings of either lime or superphosphate.

Potassium is an essential element for healthy plant and pasture growth. It is needed by plants, especially the clovers, in relatively large amounts.

With reduced clover growth there is usually a shortage of soil nitrogen and the deficient paddocks present a yellowish appearance, except for dung and urine patches, which are bright green, in marked contrast to the remainder of the pasture.

During the spring, when weather conditions are favourable for clover growth, the surviving clover plants on potassium-deficient pasture land often show small white or light brown dots on the outer margins of the leaves. As the season advances the edges of the leaves die and turn brown, and the leaves present a scorched appearance long before the rest of the clover plant dies.

Causes of deficiency

Both grass and clover hay take large quantities of potassium from the soil, and the repeated cutting of a paddock will, if the hay is not fed back on to the paddock, soon reduce the soil potassium to a deficiency level.

With grazing stock, most of the potassium is returned to the soil in the urine; the sale of animal products in the form of meat, wool and milk does not remove much potassium from the land.

On dairy farms it is a common practice to have both night and day grazing paddocks, the night paddocks usually being near the house and yards.

Under this method of grazing, shortages of potassium often develop in the day paddocks. Most of the grazing is done in the day paddocks, but the dairy herd is held in the yards and night paddocks for a large portion of the 24 hours, and there is an accumulation of droppings and potassium in these areas at the expense of the day paddocks. This drift of fertility from the outer paddocks to the home paddocks is a characteristic feature of dairy farms in Victoria.

Treatment of deficiency

The usual method of correcting a potassium deficiency in pasture land is to apply a fertiliser containing potassium. Other methods of improving the growth of potassium-deficient pastures include the use of farmyard or liquid manure, the feeding of large amounts of hay on the deficient paddocks, or, on dairy farms, changing the night paddock and using a paddock containing potassium-deficient pastures for holding the herd during the night.

When a potassium deficiency has been diagnosed it is advisable to apply in the first year sufficient fertiliser to supply the soil with potassium equivalent to that contained in 1 cwt. of muriate of potash. In succeeding years the application can be reduced and the amount used varied according to whether the deficiency is severe or mild. Where the deficiency is very severe, dressings heavier than 1 cwt. per acre may be necessary.

Paddocks deficient in potassium are quite commonly deficient also in molybdenum. In view of the relatively

Clumpy growth in a pasture is sometimes a sign of potash deficiency, particularly if the pasture is generally yellowish in appearance, while the clumps are green with healthy clover and grass

high cost of potassic fertilisers and the low cost of a molybdenum dressing, it is advisable in North-Eastern Victoria, where molybdenum has not been applied in recent years, to apply both.

In some areas of Victoria, especially near the coast, the indiscriminate use of molybdenum is undesirable from the stock health viewpoint; but there are no known molybdenum toxicity areas in North-Eastern Victoria, and on paddocks suspected of potassium deficiency it should be quite safe to apply molybdenum at normal rates.

Satisfactory results cannot be expected from dressings of potassic fertiliser unless there is also an adequate supply of available phosphorus. Some superphosphate, therefore, should be applied with the potassium. Even on paddocks that have been liberally top-dressed with superphosphate in the past it is advisable to apply some superphosphate in addition to the potassic fertiliser.

Paddocks that have responded to potassium should be carefully managed in succeeding years and, if further hay crops must be cut, the potassium removed should be replaced by means of a special fertiliser dressing.

Trial strips

Where paddocks are suspected of being deficient in potassium trial strips are advisable before the whole of the paddock is top-dressed. The rate of application to the trial strip should be at least 1 cwt. and preferably 2 cwt. of muriate of potash per acre. Trial applications made in the autumn, winter or very early spring should show responses by mid-spring, and a decision could then be made whether or not to treat the remainder of the paddock.

If the paddock containing the trial strips is grazed throughout the spring, the response to potassium may be obscured by the closer grazing given the potassium-treated strips. For this reason it is recommended that the paddock being checked should not be grazed in the early spring, or else a temporary fence should be run across the treated areas so that the growth response can be observed.

Under grazing conditions a response to potassium on a trial strip is often shown as a heavier grazed sward containing a much higher proportion of clover.

Results of potassium trials

Responses to potassium in North-Eastern Victoria have mainly been found in the higher rainfall areas. The responses have not been restricted to any particular soil type, and this suggests that potassium deficiencies may develop on a wide range of soils in the north-east.

In some instances the potassium deficiency appears to be limited to relatively small areas, while in others it seems to be widespread. In the Mansfield district, definite responses to potassium have been obtained on plots on four widely spread farms.

The following table shows the results obtained from these plots:

Plot No. 1

Treatment per acre	*Yield per acre as cut for hay in cwt. of dry matter*
Superphosphate 2 cwt.	5.1
Superphosphate 2 cwt. + potassium sulphate 1 cwt.	15.5
Difference for significance at 1% level	1.6

Plot No. 2

Treatment per acre	*Yield per acre as cut for hay in cwts. of green material*
Superphosphate 2 cwt.	73.8
Superphosphate 2 cwt. + muriate of potash 2 cwt.	120.3
Difference for significance at 1% level	18.8

Large amounts of potassium are lost in the form of droppings and urine in the home paddocks at the expense of the day paddocks which are gradually depleted

Plot No. 3

Treatment per acre	*Yield per acre as cut for hay in cwts. of green material*
Superphosphate 4 cwt.	147.8
Superphosphate 4 cwt. + muriate of potash 2 cwt.	199.9
Difference for significance at 1% level	25.2

A fertiliser distributor spreading a 1 : 1 mixture of muriate of potash and superphosphate over a pasture in Victoria

Plot No. 4

Treatment per acre	*Yield per acre as cut for hay in cwts. of green material*
No manure	58.5
Superphosphate 4 cwt.	61.6
Superphosphate 4 cwt. + muriate of potash 2 cwt.	130.4
Superphosphate 4 cwt. + molybdenum 4 oz.	48.2
Superphosphate 4 cwt. + muriate of potash 2 cwt. + molybdenum 4 oz. ..	163.5
Difference for significance at 1% level	33.2

The results from Plot 4 indicate that there was no response to either superphosphate or superphosphate plus molybdenum in the absence of potassium. However, where potassium was also applied, there was a marked response and the yield was doubled. In the presence of superphosphate and potassium, molybdenum produced a further increase in yield.

It is important to remember, when considering the above results, that not only is the total yield of herbage increased when potassium is applied, but the quality is improved, since the clover percentage is much greater than on the ' no potassium ' plots.

The results of a trial at Lima emphasised the need for applying some superphosphate with potassium, for, while in this experiment a small increase was obtained when potassium was applied without superphosphate, a marked increase was obtained in the presence of superphosphate. In this trial the following results were obtained:

Plot No. 5

Treatment per acre	*Yield per acre as cut for hay in cwts. of green material*
Nil	59.3
Superphosphate 2 cwt.	75.5
Muriate of potash 2 cwt.	98.0
Superphosphate 2 cwt. + muriate of potash 2 cwt.	137.6
Difference for significance at 1% level	38.7

Summary

On properties where cropping, grass, hay-making or special fodder crops tend to be concentrated on limited areas of more suitable land there is always the likelihood that eventually such land will become deficient in potassium. The deterioration often takes place so slowly that it occurs unnoticed and, before the symptoms of acute potassium deficiency are recognised, much production can be lost.

It is then only a matter of time before bad pasture management could make potassium deficiency a widespread problem in the higher rainfall districts.

The correction of potassium deficiency by the use of commercial fertiliser will be expensive and landowners would be well advised to avoid pasture management practices that tend to accelerate exhaustion of essential soil nutrients.

Anticipation of the expected changes and early preventive action to arrest the decline in pasture productivity should prove a better management policy than attempting to revive deteriorated pastures after they have been worked to a standstill.

Israel's Wonder Crop

(*Continued from page* 134)

will usually suffice. In most areas, where the average winter rainfall is from 15 to 20 in., no further irrigation is required until the end of April.

The mangold increases in size and weight mainly from April onwards and it is possible to keep the crop in the field until August with further increase in weight, but this requires light applications of water every fortnight.

Harvesting

The first roots are pulled in April, before reaching maximum weight, in order to allow the better development of the remainder. Top weight will not be obtained before June, which represents a growing period of about 10 months. It is not yet known, however, whether it is a more paying proposition to defer harvesting until August.

Utilisation

The crop is very acceptable to cattle, who eat it greedily and maintain a high level of milk production. The quantity fed is about 100 lb. per 1,200-lb. milking cow.

Based on Scandinavian Feeding Units, 25 lb. = 1 Feeding Unit, and based on a yield of 140–150 tons per acre (not top yields) comparative costs per unit are lucerne, 100; green maize, 75; and mangold, 45–50.

Weeds in Temperate Regions—3

The Control of Weeds in Grasslands

WEED control is one of the most important aspects of grassland management. The traditional method of controlling weeds in newly sown leys, by mowing or grazing the field as soon as the crop and the weeds are sufficiently high, has its limitations. The alternative treatment – the use of herbicides – allows the destruction of annual weeds of all types when the crop and weed seedlings are small.

Established swards can vary considerably in their composition of grasses and other plants. The good, productive swards are those in which grasses, such as perennial ryegrass, timothy, cocksfoot and meadow fescue, supported by clover, predominate; as the proportion of the less valuable grasses and weeds increases, so the potential productive capacity of the pasture falls. The killing of the useless weeds with herbicides could improve the value of a sward, if other conditions are satisfactory.

In addition to perennial weeds usually associated with grassland, rough grazings can present more rampant infestation of such weeds as bracken, rush and woody weeds, such as bramble, gorse and heather. For the improvement of such areas and to prevent the spread of weeds into adjoining pastures the use of herbicides can be most helpful.

Aerial top-dressing to improve a pasture using a fixed-wing monoplane in New Zealand. Such planes have to fly at a minimum of 70 m.p.h., and in hilly country this necessitates high flying for safety

Aerial Spraying Techniques Developed in New Zealand for Helicopters *by E. C. S. Little (Dept. of Agric., Oxford Univ.)*

New Zealand has large areas of hill country suitable for pastoral farming, but which are either occupied by scrub weeds preventing grass sowing or have established pastures invaded by weeds, such as thistles or ragwort. After the aerial application of fertilisers had been successfully developed, attempts were made to use the same aeroplanes for weed spraying, but with limited success. Fixed-wing planes have to fly at a minimum of 70 m.p.h. and on hilly country this forces high flying for safety. With increasing height above the target comes less accuracy, more loss of spraying by evaporation, and greater risk of drift.

These and other disadvantages of fixed-wing aeroplanes created a need for a slow-flying, vertical-take-off machine. The first helicopter was introduced in 1955 and it became necessary to work out the best way to use this novel means of spray application, particularly for scrub weed control. The problem presented difficulties because experimental work hitherto indicated that high volumes of spray at high pressures were essential. Such rates would be uneconomic from aircraft and there was no experience from elsewhere to draw on.

Scrub on hills

Ulex europeaus and *Cytisus* sp. have invaded large areas of hill country too difficult to spray with ground equipment. Normal high-volume rates of 400–600 gal. per acre are uneconomic from the air. During 1955–57 experiments by helicopter with spray rates of 40–60 gal. per acre with 3.6 lb. of 2,4,5-T ester showed that gorse, under certain conditions, can be killed successfully. Four passes with overlapping swaths gave good results using coarse droplets from $\frac{1}{4}$-in. jets.

Pasture weeds

(*a*) On hills.—Slow, low-flying helicopters using aqueous sprays can compete with fixed-wing aeroplanes using oil as a diluent on 2,4-D susceptible weeds.

(*b*) On level country.—Helicopters can compete with ground equipment on wet or rough country.

Forest weeds

Sodium chlorate applied by helicopter shows promise in releasing seedling pines from weed competition. Sodium arsenite sprayed through special 'solid' jets from helicopters can be used to cut tracks through scrub.

Photos: High Commissioner for New Zealand

The Use of Herbicides in the Surface Reseeding of Old Pasture *by J. G. Elliott (A.R.C. Unit of Exp. Agr., Oxford)*

This paper contains a review of the world literature on the use of herbicides in the surface reseeding of old

pasture and a discussion of the research approach. Since 1956 seven experiments have been started by the A.R.C. Unit of Experimental Agronomy to investigate the destruction of vegetation and surface root mats and to compare the various farm implements that may be used to prepare a seedbed.

The success of the surface reseeding operation will depend to a large extent on the method of dealing with the live and dead organic matter on the soil surface. In the U.K. the three main types that are likely to be encountered alone or in combination are green vegetation, a surface root mat and a layer of peat overlying the mineral soil.

Since the effect of the herbicide is to kill the green vegetation, it must be expected that trash will result from the treatment. The method of dealing with it in preparation for a seedbed will depend on the type and quantity that is present. If the trash is small in quantity it may be possible to disregard it, but a thick layer of dead vegetation would seriously interfere with cultivations, and it would therefore have to be removed by some means, such as burning. The application of the herbicide in autumn, which allows an interval of up to six months before seedbed cultivations, provides time for some breakdown of the trash to occur.

Experiments with Dalapon, Aminotriazole and 2,4-D in the Oversowing of Old Pasture *by J. O. Green, D. D. Kydd and Lewis Jones (Grassland Research Institute)*

An old pasture, composed largely of red fescue and broad-leaved herbs, was sprayed in May with these three chemicals, singly and in all combinations, to control the indigenous vegetation before oversowing with ryegrass and white clover in July.

Pre-sowing treatment with dalapon and 2,4-D ester together had an additive effect on development of ryegrass, without harm to indigenous clover. The most effective treatment, in terms of seedling development, was a mixture of dalapon at 3 lb. and 2,4-D at 1 lb. per acre.

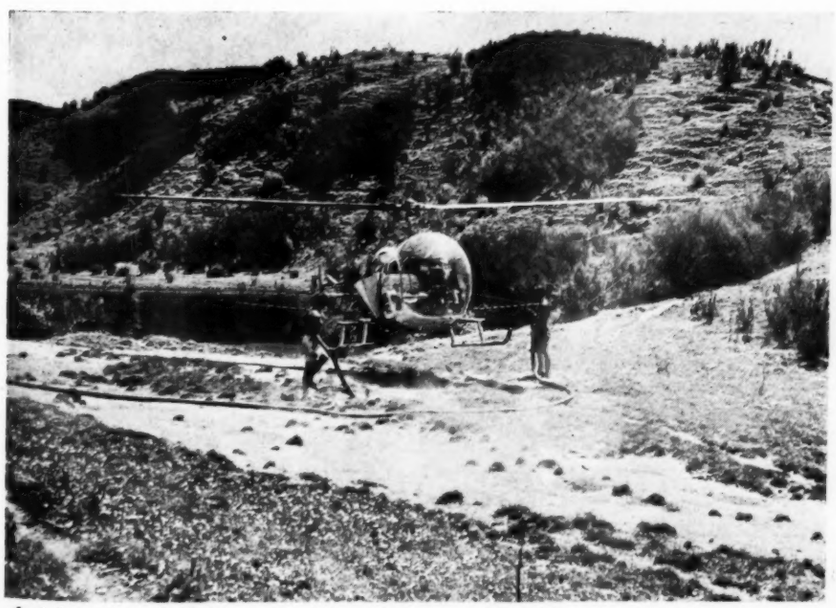
The chief obstacle to further development of ryegrass, whatever the management of the pasture, is the *Festuca rubra*, which is still co-dominant. A really significant improvement may only be accomplished by the use of dalapon at a higher rate, or some other chemical treatment which will bring about a more nearly complete, and lasting, control of *Festuca rubra*.

Trials with Dalapon in Reseeding Difficult Land *by J. F. Ormrod (N.A.A.S.)*

There are two reasons why grassland is ploughed and cultivated prior to direct reseeding: firstly, to kill the old sward; secondly, to prepare a seedbed in which the new seeds can become established. It seems that a sufficient rate of dalapon will kill most species of grasses commonly present, though there is evidence of appreciable variation in resistance between species.

Six trials are reported in which dalapon at two rates plus 2,4-D ester was sprayed on poor permanent grass to kill the existing sward prior to reseeding. A satisfactory kill was achieved in five of the six sites, except for broad-leaved species.

It was thought at the outset that the dalapon reseeding method was only likely to fit in British farming where ploughing was impossible, excessively difficult or inadvisable for some reason. The six sites were therefore chosen as typical of such land. Experience with these and other trials has confirmed this view, but has also shown that dalapon has considerable promise for these special conditions provided certain difficulties can be overcome. The value and limitations of the new technique are discussed.



Aerial spraying by helicopter in New Zealand. The hill is overrun with broom and gorse, and is being sprayed with 2,4,5-T. The machine gives a 60-ft swathe, and the ground is covered four times to give the required saturation

The Relation Between Palatability of Pastures and Selective Buttercup Control *by J. D. Phillips and R. K. Pfeiffer (Chesterford Park Research Station, Fisons Pest Control Ltd.)*

Cattle and horses try to avoid buttercup-infested parts of a pasture if they can find a piece of pasture free of this weed. The degree by which this preference is correlated to the density of buttercup infestation has never been closely studied. A weed control experiment with the logarithmic sprayer which was laid out to give information on the relative degree of buttercup control after spraying MCPA, 2,4-D, MCPB and 2,4-DB also gave fairly accurate information on the correlation between buttercup control and selective grazing. The visual correlation between grazing intensity and degree of buttercup control was very obvious.

The Effect of MCPA, MCPB and 2,4-D on the Productivity and Botanical Composition of Permanent Pasture *by R. S. L. Jeater (Plant Protection Ltd., Fernhurst Research Station)*

The use of selective weedkillers normally gives a satisfactory control of *Ranunculus repens* and *Cirsium arvense* in permanent pasture without affecting the production of total green matter of that pasture, and under the type of

management practised in these trials MCPA was a better weedkiller than MCPB or 2,4-DB.

For any quantity of weeds in the pastures investigated the production of grass and clover was reduced by a similar amount. The methods of assessing productivity are compared; a mower cuts off weeds, grass and clover alike, whereas a grazing animal is more selective. A larger part of the production from weeds is not used by the animal and is wasted, together with part of the surrounding grass and clover. The use of silage cuts for two years as a means of assessing the productivity of a sward is not suitable, as it severely reduces the amount of clover present.

The Control of Weeds in Permanent Pasture by MCPA and the Subsequent Effect on Herbage Productivity *by H. K. Baker (The Grassland Research Institute) and S. A. Evans (N.A.A.S. Liaison Officer, A.R.C. Unit of Experimental Agronomy)*

There is still a considerable acreage of permanent pasture in the U.K. which, for a variety of reasons, is dominated by inferior grasses and frequently infested with dicotyledonous weeds. Many of these weeds can now be eradicated by chemical treatments, but little work has been done, under practical conditions, to determine the effect of removing the dominant weeds on the long-term productivity of permanent pastures.

The effect of controlling weeds in a permanent pasture by spraying with MCPA upon the production of the different sward constituents was investigated for two seasons. MCPA was effective in suppressing *Ranunculus repens*, *R. acris* and various Compositae species. The clover content was, however, slightly reduced by spraying, but this reduction was temporary.

Spraying alone did not markedly affect the total herbage production of the sward, but the application of nitrogen had a much greater effect.

The Effect of 2,4-DB and MCPB on the Development of the Lucerne Plant *by R. W. E. Ball and Margery Soundy (May & Baker Ltd.)*

Lucerne is known to be less tolerant of growth-regulator herbicides than either red or white clovers and its importance as a crop in Europe and the American continent underlines the necessity of finding a weedkiller which it will tolerate.

Greenhouse and laboratory experiments were described comparing the tolerance of lucerne (var. Provence) towards MCPA, MCPB and 2,4-DB. The results showed:

(1) That 2,4-DB is approximately three times less toxic than MCPB towards lucerne, and the recovery rate is higher for 2,4-DB.

(2) That the tolerance of this variety towards 2,4-DB appears to increase up to the 1–2nd trifoliate leaf stage.

The Use of 2,4-DB in the Establishment of Lucerne Leys *by R. W. E. Ball and C. W. Wilson (May & Baker Ltd.)*

With the introduction of MCPB in 1954 a safe selective herbicide for use in the early stages of the establishment of both red and white clovers has been available to farmers. This herbicide, however, has been found to be too injurious to young lucerne, but greenhouse experiments have shown that the butyric homologue of 2,4-D is far less phytotoxic.

The results are reported of four experiments in seedling lucerne in which the sodium salt and the butyl ester of 2,4-DB and the sodium salt of MCPA were applied.

The results show that both formulations of 2,4-DB may be safely applied to seedling lucerne at any time between the spade and 4th trifoliate leaf stage. No differences in varietal response were noted between the six lucerne strains used in these experiments.

The Effects of MCPB and 2,4-DB on Established Lucerne *by R. W. E. Ball and C. W. Wilson (May & Baker Ltd.)*

Two experiments, in comparatively weed-free one-year-old lucerne stands, are reported, in which the sodium salts of 2,4-DB and MCPB and the butyl ester of 2,4-DB were compared. 2,4-DB was found to be less phytotoxic to lucerne than MCPB and the sodium salt formulation of 2,4-DB gave higher yields than the butyl ester. There are indications that recovery of lucerne is slower in the presence of vigorous grass growth. There were no differences in varietal reaction to treatment.

2,4-DB and its Butyl Ester. Residue Levels in Seedling Lucerne *by H. A. Glastonbury, M. D. Stevenson and R. W. E. Ball (May & Baker Ltd.)*

In a series of field experiments the persistence of 2,4-DB applied as the sodium salt to seedling lucerne at spray rates up to 3 lb. per acre was from seven to 28 days, and dependent upon initial dose rate and growing conditions. When the very high spray rate of 4 lb. per acre was used the limit of detection was not reached until 42 days after spraying.

In field experiments on the persistence of the butyl ester of 2,4-DB in seedling lucerne the ester was rapidly broken down to 2,4-DB in the plant.

The persistence of 2,4-DB in ester-treated plants was longer than in plants treated under the same conditions with the equivalent rate of the sodium salt.

Corrosion Exhibition, 1959

Protecting hundreds of millions of pounds' worth of Armed Forces' equipment against corrosion damage is a major task of Ministry of Supply scientists. It is appropriate, therefore that the V.I.P. who will open Britain's 1959 Corrosion Exhibition on Monday 27 April, is the Chief Scientist of the Ministry of Supply, Sir Owen Wansbrough - Jones, K.B.E., C.B., PH.D., F.R.I.C.

Sir Owen, who runs one of the biggest scientific organisations in the country, was trained as a physical chemist at Cambridge under Sir Eric Rideal and at Berlin under Fritz Haber. Soon after the war started he was in the Army, working on chemical warfare, but the scope of his work widened to embrace a variety of scientific and technical matters which he tackled as a General Staff officer. He became Scientific Adviser to the Army Council in 1946. In 1950 he transferred to the Ministry of Supply as Director-General of Scientific Research in respect of Army requirements and two years later was promoted to Chief Scientist.

Over 70 exhibitors will show the newest techniques in dealing with corrosion. Readers of 'WORLD CROPS' may obtain complimentary tickets by writing to the Editor.

Systemic Insecticides — A Recent Development

Q. A. GEERING, M.A.
(*Chesterford Park Research Station*)

The usefulness of the systemic organophosphorous insecticides has been recognised since they were first developed in 1939. Their main disadvantages were their high degree of toxicity to man and the limited range of insect pests controlled. The discovery and development of Rogor* gives tangible proof that increases in insecticidal effectiveness and mammalian safety are attainable in organophosphorus compounds.

Aphis on tobacco in Southern Rhodesia

A SYSTEMIC insecticide is one which, when sprayed on to a plant, is absorbed into the leaves and other aerial parts and then spreads throughout the tissues from the point of application. Such compounds are also readily absorbed from the soil by the roots and translocated by the vascular system to all parts of the plant (Fig. 1). Sucking pests, such as aphids and red spider mites, are thus killed at a distance from the site of application by feeding on the plant sap.

This feature can be valuable for controlling, for example, aphids either within curled leaves or on new growth. Additional advantages are that a persistent kill can be maintained for a reasonable period, and once the material is absorbed into the plant it cannot be removed by rain. Furthermore, a selective action is possible, since predators and parasites occurring on a treated plant are not killed once the insecticide is fully absorbed.

The systemic insecticides

The majority of the modern systemic insecticides belong to a group of synthetic chemicals known as organophosphorus compounds. Described briefly, the molecules of these chemicals are made up of organic groups arranged around a central phosphorus atom and may also contain sulphur atoms. Many of these insecticides have no systemic action in plants, and most of those which are systemic within plants can also kill insects by direct contact action before absorption.

Schradan, the first systemic organophosphorus insecticide, was produced in Germany in 1939. Then others, notably demeton and dimefox, were discovered. The main disadvantage of these early systemic insecticides was their high toxicity to warm-blooded animals, including man; in addition, they mainly controlled only two groups of insects, the aphids and spider mites. The discovery of demeton-methyl was a welcome advance in the development of this type of insecticide, since its use is not restricted entirely to aphids and mites, and it is also much less toxic to higher animals.

Rogor, a more recent systemic compound, represents a further advance in that it combines a systemic action with an even lower mammalian toxicity and is showing effectiveness against a wider range of pests. Rogor is O,O - dimethyl S - (methylcarbamoylmethyl) phosphorothiolothionate whose molecular formula is $(CH_3)_2$ P(:S).SCH_2.CO.$NHCH_3$. It is moderately soluble in water (3%), readily soluble in many organic solvents, and adequately stable to aqueous hydrolysis. The investigations reported here have been conducted with pure and technical material, and a soluble oil formulation containing 40% w.v. technical rogor.

Toxicology of Rogor

An extremely thorough investigation of the toxicology of rogor has been made in the past two years on all aspects of safety to users, food consumers, stock and wild life. The work has involved studies on many species of laboratory animals, on fish, bees, and also on groups of human volunteers.

Early results showed that, although rogor in high dosage caused typical anticholinesterase organo-phosphorus effects, its acute oral and dermal toxicity compared favourably or very favourably with that of other existing systemic insecticides (Table 1).

Subsequent studies concentrated on these main problems:

1. Evaluation of skin absorption risks during use.
2. Demonstration of a 'no-effect' daily dosage rate by duplicated dietary feeding trials on rats, then confirmatory human studies to permit a tentative 'safe residues limit'.
3. Chemical determination of rogor residues on many varieties of treated food crops.

* 'Rogor' is the registered trade mark of Montecatini.

Fig. 1. Systemic effect of Rogor on brussels sprouts. Both plants were subjected to aphid attack, Myzus persicae, continuously for 35 days. Left: control; right, soil application of 9.5 mg.

4. Confirmation of safety during the first two years of field use.

Result of toxicity trials

The results can be summarised as follows:

Skin absorption of formulated technical material is very slow and decontamination is easy. Safety tests with human volunteer subjects have shown that one whole hand could be contaminated with a 40% formulation for two hours before washing, with no detectable effects.

Crop Residues. Dietary feeding trials have led to the setting of a tentative 'safe residues limit' of 2 *p.p.m.* in considering food crop safety.

A very satisfactory chemical analysis method exists for the determination of rogor residues in food crops. Experimental trials showed that rogor residues in treated crops decreased comparatively rapidly. Field trials on a range of 23 British crops confirmed this. Of 65 samples of the edible portion of the crops taken at seven days or less after spraying, 97% had residues below 2 p.p.m. and 79% below 1 p.p.m. Of 77 samples taken at 14 days, all were below 2 p.p.m. and 93% below 1 p.p.m.

Trials on a large number of overseas food crops of many types have given essentially similar results. A special study on guinea pigs showed that the toxicity of rogor was similar when administered as pure material, or as a known residue concentration in greenstuff. The low dietary toxicity of rogor, and its speed of decrease in the edible portion of the crop, suggest that this insecticide should present no public health problem as a food contaminant, if a suitable interval – seven days – is allowed before harvesting.

Safety in the Field. The toxicity of rogor to fish appears satisfactorily low; trout could live for seven days in a concentration of 12 p.p.m. Risks to game and wild life are negligibly

Table 1
Acute oral and dermal LD 50 values for Rogor and four other systemic O.P. insecticides, in the rat

Compound	*Oral LD 50 (mg./kg.)*	*Demarl LD 50 (mg./kg.)*
Rogor ..	150–250	750–1,000
Methyl demeton	80	400–450
Demeton	4	300–400
Schradan	5	50–100
Dimefox	1	10

(All material tested as commercial formulation; LD 50 values expressed as mg. active ingredient/kg. bodyweight).

Table 2
Effectiveness of Rogor against certain pests of crops in U.K.

Successful results: i.e. trials completed and recommendations made

Pest	*Application Rate**	*Crop*
Aphids	12 – 20	Sugar beet Apples Brassicas Strawberries Peas Beans
Red Spider mite ..	12	Apples Strawberries Tomatoes Cucumbers Carnations
Leaf miners	4	Sugar beet Celery Cinerarias

Promising results: i.e. initial trials show good control

Pest	*Application Rate*	*Crop*
Aphids	16	Carrots
Psyllids	16	Apples
Thrips	16	Carnations
Byrobia mite	8	Gooseberries
Sawfly	16	Plums, Apples
Frit fly	20	Oats
Midge	20	Peas
Caterpillars	16	Apples

Inconclusive results: i.e. initial trials unsuccessful or inconsistent

Pest	*Application rate*	*Crop*
Root flies	—	Cabbages, cauliflowers, brussels sprouts
Bigbud mite	—	Currants

* Fluid oz. of 40% formulation per 100 gal.

Table 3
Crops and pests on which successful use of Rogor is reported from overseas

Pest	*Crop*	*Country*	*Concentration of 40% soluble oil formulation*
Aphids	Cotton	Sudan	1.5% (2 gal./acre)
	Tobacco	S. Rhodesia	0.25% (soil drench)
	Cereals	S. Africa	0.05%
	Brassicas	New Zealand	0.1%
	Artichokes	Mauritius	0.05%
Red Spider mite	Pyrethrum	Kenya	0.20% (30 gal./acre)
	Apple	S. Africa	0.05%
	Tomatoes	Mauritius	0.05%
Bryobia mite ..	Peach	S. Africa	0.05%
	Plum	,,	,,
	Apple	,,	,,
Red Scale ..	Citrus	Cyprus	0.25%
	,,	Kenya	,,
	,,	Australia	0.20%
White flies ..	Cotton	Sudan	6.25% (2 gal./acre)
	Tobacco	Nigeria	0.10%
Thrips	Pyrethrum	Kenya	0.20% (30 gal./acre)
	Cotton	Sudan	6.25% (2 gal./acre)
Jassid	Cotton	Sudan	6.25% (2 gall./acre)

Except where stated otherwise, all applications were made in 100 gal./acre.

slight. Bees are somewhat susceptible to rogor, apparently to the same extent as their susceptibility to methyl-demeton.

Close observation on the possible side-effects of over 2,000 acres of rogor application in Britain last summer revealed no instances of complaint or cholinesterase depression among users (including one spray operator who himself sprayed 470 acres of sugar-beet), no casualties among farm stock, bees, game or fish. Regular blood tests have been made on all employees engaged in formulation, laboratory, research trials and contract application in the past two seasons. No instance of health complaint or blood cholin-esterase depression has arisen.

On these findings, and others not included above, rogor may be regarded as a comparatively safe insecticide, representing a material advance in safety among those compounds with a predominantly systemic mode of action. Its use in temperate climates seems likely to cause no adverse prob-lems and its increased order of safety, especially as regards skin contamina-tion, makes it particularly promising for use in tropical or sub-tropical territories.

The British Government's Advisory Committee having considered the results of all toxicological and residue studies, has now formally recom-mended that rogor need not be in-cluded among the scheduled poisonous pesticides, and that it may be used on any British food crop, subject only to the restriction that an interval of seven days should be allowed between last application and harvesting. (Recom-mendations made January 1959.)

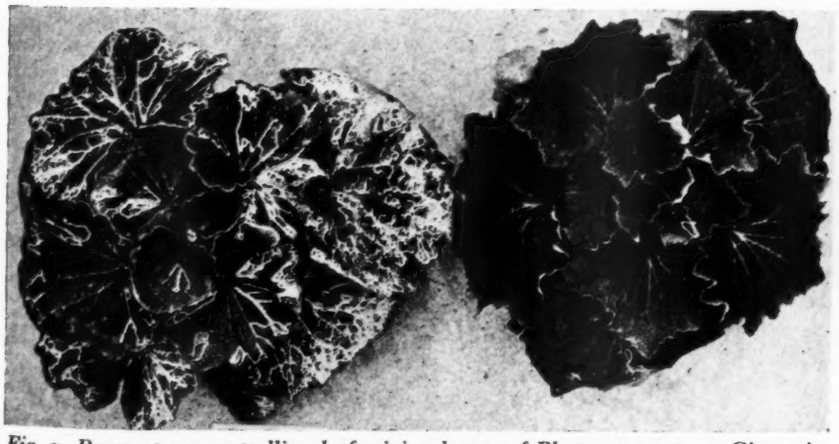


Fig. 2. Rogor spray controlling leaf-mining larvae of Phytomyza spp. on Cineraria. The plants were continuously exposed to attack for 12 days after spraying. Control plant on left

Insecticidal activity of rogor

Rogor was first developed as an insecticide for the control of two im-portant olive pests, olive fly, *Dacus oleae*, and olive moth, *Prays oleus*, in Italy by Montecatini Ltd., Milan. It has been tested extensively for this purpose and is widely used for control of these pests in the Mediterranean region.

Since early 1957 widespread testing of rogor has been carried out in the U.K. and in Commonwealth terri-tories. A soluble oil formulation con-taining 40% technical rogor has been used throughout and is the formulation at present available in the Common-wealth. Intensive work in the U.K. has demonstrated that rogor is an extremely efficient insecticide for the control of aphids, red spider mites and leaf-mining dipterous larvae on a wide range of agricultural and horticultural crops. Its efficiency for control of leaf-mining dipterous larvae is illus-trated in Fig. 2; and the marked systemic action is shown in Fig. 1. In the field, Fuggles varieties of hops have been successfully treated with a soil application of rogor (0.5 gm. tech-nical rogor per hill), when protection from aphis lasted for six weeks.

In 1958, trials on sugar-beet demon-strated that a single spray of rogor applied in June reduced the incidence of virus yellows by controlling the vector aphid, *Myzus persicae*. Sig-nificant increases in yield up to 1.6 tons per acre of washed beet resulted.

The results obtained to date in the

U.K. are summarised in Table 2, where successful and promising results, and also those which are inconclusive, are listed separately.

Trial reports from Switzerland indicate that the range of pests on top fruit which are controlled by rogor can be extended to include pear midge, *Contarinia pyrivora*, pear Psylla, *Psylla pyri*, the cherry fruit fly, *Rhagoletis cerasi*, and caterpillars of the winter moth, *Operophtera* spp. It appears that only the very early instars of Lepidopterous caterpillars are controlled by rogor; its effect against this type of pest will therefore depend on timing of the spray application.

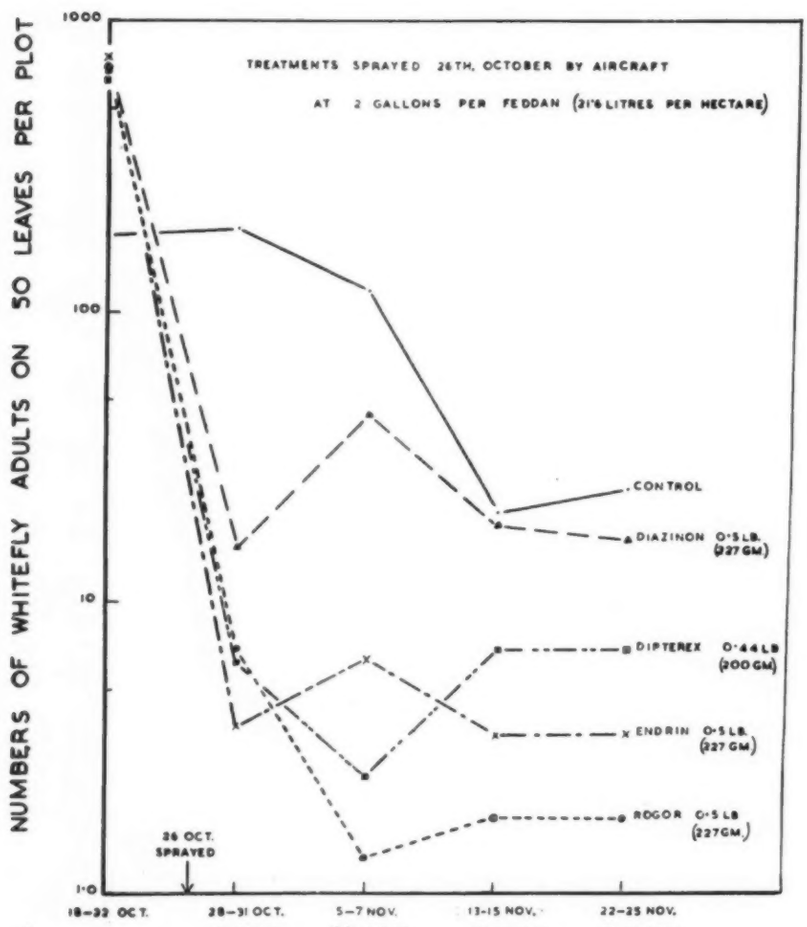
Fig. 3. Rogor being applied from a fixed-wing monoplane to cotton in the Sudan

Overseas territories

Trials have been conducted in the following Commonwealth and independent territories, mostly by research institutes: South, East, Central and West Africa, Cyprus, Mauritius, India, Australia, New Zealand, British Guiana, Jamaica and Trinidad, and the Republic of the Sudan.

The results available to date are summarised briefly in Table 3. Some results are not yet complete and more information is still being accumulated.

CONTROL OF COTTON WHITEFLY (Bemisia gossypiperda) IN THE SUDAN



The situation on cotton pests in the Sudan is worth reporting in some detail, since the information relates to trials where rogor was sprayed by fixed-wing aircraft.

In the Sudan the irrigated cotton crop, extending to more than 600,000 acres, is attacked by a complex of insect pests, including the more important jassid, *Empoasca lybica*, whitefly, *Bemisia tabaci*, thrips, *Thrips tabaci*, and aphids, *Aphis gossypii*. Jassid is readily controlled by a single spray of DDT applied in October, but this does not control the whitefly, and over large areas of the crop it has become apparent that control of whitefly is equally as important as the control of jassid.

In October 1958 a trial was laid down on one of the privately owned irrigation schemes in the Sennar area of the Blue Nile. The object of the trial was to compare the performances of four chemicals, *viz.* rogor, diazinon, endrin and dipterex* for the control of whitefly. The immature stages of the scales of the whitefly occur on the undersides of the leaves, and these chemicals were chosen to compare rogor, possessing marked systemic properties, with dipterex and diazinon, which are contact insecticides, but can be absorbed into the leaf, and endrin, which is predominantly a contact insecticide with good residual properties.

Sprays were applied by fixed-wing aircraft (Fig. 3) at 2 gal. per acre to test plots of 5 acres; treatments were replicated four times, but only one adjacent unsprayed 5-acre plot was

*Dimethyl trichlorohydroxyethylphosphonate.

available as a control. Assessment of performance was based on early morning counts of adult whiteflies made before and at intervals during four weeks following spraying. The counts are shown in the accompanying graph (Fig. 4), where arithmetic means are plotted on a logarithmic scale.

Statistical analysis of counts showed that at 10 to 12 days after spraying rogor plots had fewer whiteflies than all other treatments. At subsequent counts rogor and endrin performed equally well, but diazinon was significantly inferior. Dipterex did not appear to have the same persistence as rogor and endrin, although its initial effect was as good.

It thus appears that the single spray of rogor and endrin have both given good control of whitefly for up to 27 days. In the same trial complete control of aphis was effected. Other trials have shown good control of jassid and thrips, and rogor thus appears to be a promising addition to the range of chemicals available for control of cotton pests. Its standard of safety in respect of humans, adjacent food crops, domestic animals and fish may be of special value under the conditions in large-scale irrigation schemes.

Phytotoxicity

During field trials phytotoxicity effects have been observed on only two crops, *viz.* some varieties of hops and chrysanthemums. In view of these findings rogor cannot at present be recommended for use on these crops.

Conclusions

The development work reported here indicates that rogor is a very useful addition to the range of currently available systemic insecticides. A pattern of development of these insecticides is now becoming apparent, *i.e.* a progressive reduction in mammalian toxicity accompanied by an increase in degree and range of insect toxicity. Further improvement in systemic insecticides may confidently be forecast. However, progress in such a complex field as specific and selective toxicity is still likely to be slow. In the meantime, rogor appears to give tangible proof that increases in insecticidal effectiveness and mammalian safety are attainable in systemic organophosphorus compounds.

ACKNOWLEDGEMENTS

The author is grateful to Mr. B. J. Wood and Mr. F. A. Squire for permission to refer to results of experiments carried out respectively in Cyprus and Nigeria.

Villiers Versatility

Engines Packed with Power

THE exhibition with which Villiers celebrated their Diamond Jubilee demonstrated the amazing versatility of these powerful small engines, which range from a 34-c.c. 2-stroke to an 824-c.c. 4-stroke, and showed their many applications in agricultural and horticultural machinery. Some 350 different types of machine, powered by Villiers engines, were displayed in groups, according to type, so that it was possible to inspect the products of, say, a dozen manufacturers in each section.

There was an imposing array of mechanical scythes, hedge trimmers, motor mowers, rotary grass cutters and light powered cultivators. In the cultivator section small garden models were shown side by side with the more powerful machines used by commercial growers. Each was equipped with a different attachment to demonstrate their many uses. Power is also needed for the machines used for the protection of commercial crops and ornamental plants.

Villiers engines are indeed performing a hundred and one tasks, driving balers and elevators on one hand, and small milking machines on the other. These engines are also fitted to hoists and winches, water pumps, air compressors and electric generators, all needed on the farm and plantation.

The following list of manufacturers who exhibited their products in the sections devoted to agricultural and horticultural machinery will be of interest to our readers:

Chain saws

J. Clubley Armstrong Danarm Ltd., Heli-Strand Tools Ltd., Liner Concrete Machinery Ltd., Teles Smith Ltd.

Compost shredder-mixers

H. Pattisson & Co. Ltd., Pneulec Ltd.

Cultivators

Allen & Simmonds (Auto-Culto) Ltd., Barford (Agricultural) Ltd., Clifford Cultivators Ltd., Landmaster Ltd., Geo. Monro Ltd., Raven Engineering Co. Ltd., Robinsons Developments Ltd., Rotary Hoes Ltd., J. E. Shay Ltd., Tractors (London) Ltd.

Farm elevators

Blackstone & Co. Ltd., A. B. Blanch & Co. Ltd., Wm. Cook & Co. Ltd., Hart Agricultural Engineering Co. Ltd., Mitchell Ropeways Ltd., G. C. Ogle & Sons Ltd., Russells (Kirbymoorside) Ltd., Salmon Engineering Co. Ltd., W. T. Teagle (Machinery) Ltd.

Grain driers and air heaters

Barronia Metals (Great Britain) Ltd., Chinook Heaters Ltd., Scottish Mech. Light Ind. Ltd., Calor Gas (Distributing) Co. Ltd.

Grain elevators (spiral lift)

Byron Farm Machinery Ltd., Gordon Felber & Co. Ltd., Mitchell Colman & Co. Ltd., Ruston's Engineering Co. Ltd.

Grain transporters

N. Tamplin & Co. Ltd.

Harvesters and balers

Bamfords Ltd., A. B. Blanch & Co. Ltd., New Holland Machine Co. Ltd., Massey-Ferguson (Gt. Britain) Ltd.

Hedge trimmers

A. B. Blanch & Co. Ltd., Heli-Strand Tools Ltd., Teles Smith Ltd., C. I. Wilson.

Lifting and loading equipment

R. H. Corbett & Co. Ltd., Industrial Machinery Equipment (Brimpex) Ltd.

Milking machines

Alfa Laval Co. Ltd., R. J. Fullwood & Bland Ltd., Gascoignes (Reading)

Ltd., Manus (Gt. Britain) Ltd., Mellotte Separator Sales Ltd., Simplex Dairy Equipment Co. Ltd.

Motor mowers

Thomas Green & Son Ltd., J.P. Engineering Co. Ltd., Lloyd & Co. (Letchworth) Ltd., Charles H. Pugh Ltd., Qualcast Ltd., E. F. Ranger (Ferring) Ltd., Ransomes, Sims and Jefferies Ltd., H. C. Webb & Co. Ltd.

Motor scythes

John Allen & Sons (Oxford) Ltd., Barford (Agricultural) Ltd., Cylinder Components Ltd., Lloyds & Co. (Letchworth) Ltd., Mayfield Engineering Co. Ltd., Charles H. Pugh Ltd., Standard Insulator Co. Ltd.

Palm kernel nut cracker

Adam Knox Ltd.

Potato sorters and winnowing machines

Cooch & Sons Ltd., J. B. Edlington & Co. Ltd., E. J. Tong & Sons.

Pumps

Associated Pumps Ltd., Atalanta Motors Ltd., Auto Diesels Ltd., James Beresford & Sons Ltd., John Blake Ltd., F. W. Brackett & Co. Ltd., Crown Pump Manufacturing Co. Ltd., A. F. Dandridge & Sons, Douglas Ellison Ltd., Joseph Evans & Sons (W'ton) Ltd., Gilbert Gilkes & Gordon Ltd., Girdlestone Pumps Ltd., H. J. Godwin Ltd., Goodenough Pumps Ltd., Hampson Industries Ltd., L. Hathaway Ltd., Hill-Barnes (Pumps) Ltd., C. H. Johnson (Machinery) Ltd., Lead Wool Co. Ltd., Lee Howl & Co. Ltd., R. A. Lister & Co. Ltd., Arthur Lyon & Co. (Engineers) Ltd., Robert Moreton & Co. Ltd., Mono Pumps Ltd., Morrison Pumps Ltd., Onneley Implements Ltd., Oswalds & Ridgeway Ltd., Pegson Ltd., Ransomes & Rapier Ltd., Saunders Valve Co., Sealed Motor Construction Co. Ltd., Wm. R. Selwood Ltd., Sigmund Pumps Ltd., H. Sykes Ltd., Thomas & Son (Worcester) Ltd., Warsop Power Tools Ltd., Warwick Pumps Ltd., Wayne Tank and Pump Co. Ltd., D. Wickham & Co. Ltd., Wolseley Engineering Co. Ltd., Worthington, Simpson Ltd.

Rotary grass cutters

John Allen & Sons (Oxford) Ltd., Barford (Agricultural) Ltd., Catchpole Engineering Ltd., Thomas Green & Sons Ltd., Hayters Ltd., G. E. Holt Ltd., H. R. Nash Ltd., Pressure Jet Markers Ltd., Charles H. Pugh Ltd., Qualcast Ltd., Ransomes, Sims and Jefferies Ltd.

Sheep-shearing machines

Cooper-Stewart Engineering Co. Ltd., R. A. Lister & Co. Ltd.

Spraying and dusting equipment

E. Allman & Co. Ltd., J. W. Chafer Ltd., Cooper Pegler & Co. Ltd., W. J. Craven & Co. Ltd., Dorman Sprayer Ltd., Drake and Fletcher Ltd., Four Oaks Spraying Machine Co. Ltd., Lister-Todd Engineering Corporation Ltd., Micron Sprayers Ltd.

Borgo a Mozzano

Film produced by Shell Italiana Ltd. in sound and colour. 35 and 16 mm. Time 40 min.

The film takes its title from a Tuscan village chosen by Shell Italiana for an experiment in the improvement of peasant agriculture.

Borgo a Mozzano is representative of many such villages struggling unsuccessfully to be self-supporting. In this region 70% of the population is employed in agriculture. The small peasant holding predominates, producing olives, grapes, cereals, potatoes and forage, and supporting an average of one or two head of cattle on each farm. The almost total lack of agricultural machinery makes every job difficult and laborious.

Rather than offer financial aid – which would have been pointless in a country where it is not merely capital that is lacking – it was decided to see what could be done to stimulate and guide the individual spirit of initiative. Accordingly, in 1954 a young agronomist was sent to study the local problems, and to persuade and help the farmer to adopt more rational methods.

The film shows how, in spite of resentment and opposition, the agronomist was able to put his principles to work at first on a few farms and then gradually extending to 20% of the total, until finally even the most reluctant were ultimately convinced by the results obtained.

For example, it was demonstrated that hybrid maize can yield larger crops than the local seed. Yield was thereby increased from 10 to 40 quintals per ha., with a corresponding increase in income of 40,000 lire (£22 10s.). A hundred farms, planted with the new seed, have increased their yields by 30 to 50%.

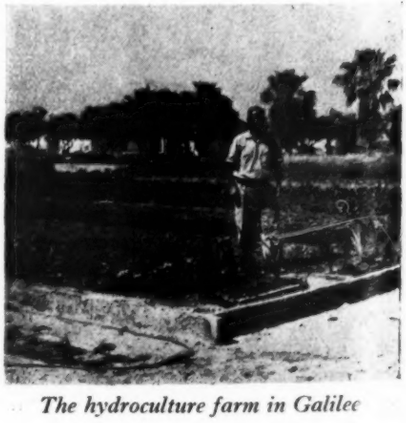
Special displays were organised and tractors, mechanical cultivators and transport vehicles of every type were tested under the arduous, hilly conditions. The farmers saw the display, the younger generation took the initiative, and today several machines and implements are in use where the conditions are suitable.

The scheme now has the active support of the local population and it has been estimated that the increase in income derived from the experiment is five times greater than the cost of the technical assistance. But the most important change has been in the outlook of the inhabitants, who are now willing to co-operate for their mutual benefit.

Hydroculture in Israel

In a village in Galilee, maize, vegetables and flowers are being grown by a patent process, known as the Pirak hydroculture system, in which peat is being used as the medium for retaining moisture and nutrient chemicals. Actually a mixture of sand and peat is used. It is considered that this system is likely to be more profitable than hydroponics in the arid areas.

While the possibilities of hydroponics are still under investigation and trial in Israel, the new hydroculture system is being organised on a commercial basis and 2,000 sq. metres are at present under cultivation, and the company concerned is considering extending their activities to other countries.



The hydroculture farm in Galilee

Fighting the Cocoa Capsid in Ghana—2

N. WRIGHT, B.SC., A.R.C.S., A.I.C.T.A.
(*Fernhurst Research Station*)

THE very great promise of the experiments, previously described, impressed the mission of U.S. Cocoa and Chocolate manufacturers, when they visited Ghana in late 1954. At their suggestion the Department of Agriculture, as soon as a standard treatment had been decided in early 1956, put their *Saturation Spraying Scheme* into operation. This involved the spraying of all cocoa within a total area of about 150,000 acres situated in Western Ashanti. Soon afterwards, in July 1956, yet another scheme was started known as the *Mature Cocoa Extension Spraying Scheme*; the object of this scheme was to treat all the most badly damaged cocoa in Ghana – an area of approximately 700,000 acres of bearing cocoa.

Both these schemes called for the organisation of a gang-spraying technique which would take into account the irregular shape and absence of planting lines in cocoa farms. The detailed survey data, already prepared by the Department of Agriculture, were indispensable in devising a scheme for the demarcation of spraying areas and enabled a field technique to be successfully evolved within three months of beginning these formidable tasks.

Spraying teams, each consisting of 5 – 7 gangs, were based on the cocoa stations, scattered throughout the country ; each gang had 5 mistblowers in use (2 operators per machine) with 2 spares and spraying was carried out with the machines in line at 8-yard intervals, moving along a previously demarcated line under the guidance of a headman. Spare operators meantime mixed the next spray charge and prepared to refill tanks and exchange operators. Full details of the procedure have been published by Hammond.[1]

For these two schemes 800 mistblowers (the ' Motoblo ') were employed. Their maintenance in sound working order presented one of the most formidable obstacles and this was not achieved until four servicing depots had been established and staffed by trained personnel. Both schemes were completed successfully during 1958.

As a result of previous experiments and trials, the spraying of 2¼ million acres of cocoa in Ghana is now to be undertaken at a cost of no less than £2½ million per annum.

The experience gained in these operations over the past two years made possible the implementation of a yet more ambitious scheme proposed by Professor Lewis, Economic Adviser to the Prime Minister of Ghana. Known as the *Routine Gang Spraying Scheme*, it is proposed to spray 2¼ million acres of cocoa annually with gangs working from fixed headquarters. Because the same cocoa areas will be sprayed every year the application rate of ' Gammalin ' 20 has been reduced to two treatments of ½ pint per acre each – *i.e.* 2 oz. gamma-BHC per acre. The large organisation required for this task is now being built up and will ultimately consist of 420 spraying gangs (approximately 14,000 men) operating 3,500 mistblowers. Servicing depots will be increased to six, and three engineers (seconded from Plant Protection Ltd.) are in charge of machinery maintenance.

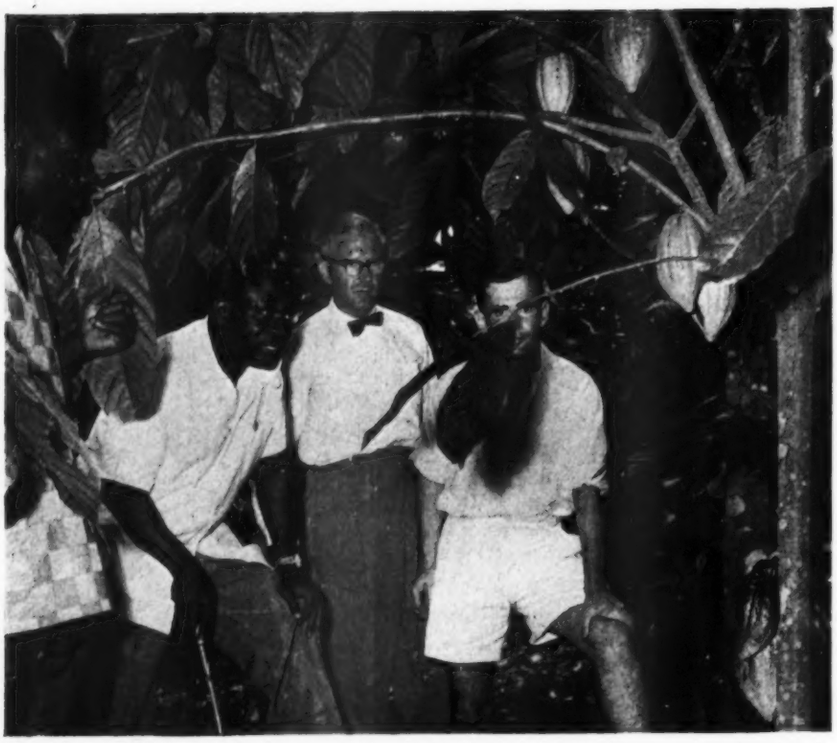
The annual consumption of ' Gammalin ' 20 under this programme is likely to be very considerable. Special steps have had to be taken to arrange for its local formulation, packing and distribution to cocoa centres. By July, 1959, Imperial Chemical Industries Ltd. will have in operation the first insecticide factory in West Africa, employing Ghanian labour; ' Gammalin ' 20 coming from this factory will be transported by tankers to 20 centres in the cocoa belt at each of which 2,000 gal. storage tanks are to be erected.

Spraying cocoa with ' Gammalin 20 ' using the ' Motoblo,' which has a polythene tank

Economics of spraying

A spraying campaign on the scale of the Ghana Government scheme is a unique venture. Few other countries depend so largely on the production of a single crop. The capsid problem has been a relatively straightforward issue from the biologists' point of view and the choice of gamma-BHC as an insecticide has resulted in a high degree of control without serious complications. It is in the development of an economical, yet efficient organisation for keeping a large number of spraying teams operating continuously throughout the year where the Ghana planners have had to meet the most difficult problems.

The maintenance of several thousand engine-driven mistblowers, in daily use by unskilled African labour, was a task on which there was no previous experience to draw. The figures in Table 2, showing in outline



The Prime Minister, Dr. Kwame Nkrumah, inspecting healthy cocoa with a heavy canopy of leaves at the West African Research Institute. On his left is Mr. James Lamb, the Director, and on his right Mr. A. Yeboah Afari, the Minister of Agriculture

Table 2

	Cost per acre per round of spraying s.	d.
Application costs		
Petrol		3
Direct application ..	4	6
Supervisory application charges ..	1	8½
Share in chemical and fuel transport ..		5
Total ..	6	10½
Cost of machines and their maintenance		
Depot maintenance		4
Team fitter maintenance		1
Spares		1
Depreciation (4 years) on mistblowers and other equipment ..		2
Write-off of workshops and running costs		¾
Total ..		8¾

the breakdown of machinery and application costs, are given here if only to emphasise that the use of trained engineers and fitters and the setting up of fully equipped service depots are not expensive when measured in terms of the large treated acreage. The figures are based on the assumption that each gang will spray 35 acres per day for 312 days of the year.

The efficiency of every gang is all important; for example, if the gang average were reduced from 35 to 30 acres per day, application costs would increase by 17% or £280,000 per year; conversely, of course, the only appreciable saving in cost can be achieved by increasing the acreage sprayed per gang.

Cost of spraying

We have seen earlier how conservative is the Government's estimate of a 25% increase in cocoa output. At present cocoa prices, the cost of spraying – about £2,500,000 per annum (two rounds) – should be repaid several times over. The farmer gets a free spraying service and in addition reaps the reward of a bigger crop. Farms outside the scheme are also being helped in a number of ways; the farmer can be taught how to use different types of spraying equipment at the agricultural schools, he is advised when spraying is necessary and he is to be helped very materially by subsidised prices to obtain the necessary chemical and sprayers.

The Government of Ghana is to be congratulated on its bold foresight and determination to fight the cocoa capsid menace by the most modern methods available. The Division of Agriculture has had the responsibility of finding the solution, then putting the results into practical effect. This brief and necessarily incomplete account pays tribute to the success of their efforts in the belief that the lessons to be learnt from it which are of great value to other countries.

REFERENCE

1. Hammond, P. S., 1957, 'Capsid Control on Mature Cocoa', *New Gold Coast Farmer*, 1, No. 3.

Colonial Development Grants in December

The British Solomon Islands and British Guiana have received £34,105 and £14,409 respectively for cocoa development and British Guiana a further grant of £10,054 for surveys for drainage and irrigation projects. Sierra Leone has received £34,290 for the construction of a road which, when completed, will link areas rich in coffee, cocoa and timber with trading areas in the South-East Province. The Seychelles has been given a loan of £10,000 for the development of its tourist industry by private enterprise and a grant of £4,000 for the appointment of an agronomist for coconut research.

Technical News

Articles in the April issue of some of the other journals of the Leonard Hill Technical Group include the following:

Chemical & Process Engineering. – 'New Applications of Plastics in Chemical Plant' by J. H. Collins, B.SC., F.R.I.C.

Corrosion Technology. – 'Preview of the Corrosion Exhibition'.

Dairy Engineering. – 'Natural and Artificial Causes of Radioactivity in Milk' by D. J. McWeeny, B.SC. 'Floors and Walls for Dairies'.

Specimen copies of the above journals are available on application to Leonard Hill House, Eden Street, London, N.W.1.

New Publications

Tropical Agriculture

An Introduction to Tropical Agriculture. By Sir Harold Tempany and D. H. Grist. Pp. 347. Illustrated. London: Longmans, Green & Co. Ltd. 40s.

Sir Harold Tempany was one of a band of keen young men who a generation ago decided to devote their lives to the improvement of tropical agriculture. He began in Mauritius, worked subsequently in Malaya and the West Indies, was later at the Colonial Office as Agricultural Advisor and finally, after his official retirement, he became the first editor of WORLD CROPS until his death. Therefore he had unrivalled opportunities for acquiring a fund of knowledge on tropical agriculture, which it was known he intended to put into a book; unfortunately, he did not live to carry out his plan. Happily, Mr. Grist was willing to complete the work. He is already widely known for his illuminating book on ' Rice ', and he has very skilfully accomplished his latest task.

The book covers a wide range. It begins with a description of the tropical background: the climatic and vegetation factors and the soils – this last an important contribution by H. Greene – there is also a useful section on crop research institutes in the tropics. Then follow chapters on the various branches of agricultural practice, beginning rightly with soil conservation and continuing with accounts of crop production and crop protection, animal husbandry, crop processing and storage and ending finally with a discussion of the economic factors – marketing and transport, land tenure, finance and credit.

The original farming system seems almost everywhere to have been shifting cultivation. This had the advantage of being permanent so long as the soil did not get washed or blown away, but it required a considerable expanse of land and was practicable only so long as high infant and juvenile mortality kept the population at a low level. The extension of medical services to all tropical countries changed this state of affairs and more productive systems are therefore needed.

A further complication is that traders have taken seductive wares into the most remote regions and the cultivator must produce something saleable in order to acquire them. Problems of increasing complexity have therefore arisen, which are ably discussed in broad principle, though in many cases one could have wished for greater detail. Mr. Grist explains in the introduction that he has not been always able to trace the source of information used by Sir Harold, and in consequence there is a certain vagueness in some of the statements about which fuller information and some examples would have been desirable, *e.g.* on p. 63, ' the introduction of ploughing, unaccompanied by soil conservation measures, which resulted in serious damage to native lands in various parts of Africa '.

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Other miscellaneous publications reviewed should be obtained direct from the addresses given.

The dominating part played by the small producer in tropical agriculture is rightly stressed; they are responsible for more than two-thirds of total production, including about 75% of the cocoa, half the rubber, most of the cotton and practically all the rice and other foods. The plantation system, in spite of its greater efficiency, has been discouraged on social grounds, and yet co-operative farming, which could have done so much, has not taken hold in the tropics. Neither in West nor in East Africa were our efforts acceptable, nor have the Dutch in New Guinea been any more successful. This is not peculiar to Africa: it is deep down in the peasant mentality; the large co-operative farms established in Poland during the Russian domination broke up when the hold was relaxed.

Co-operative lending and marketing have been more successful so long as strict supervision by Europeans is practicable, otherwise the temptation to embezzlement of the funds and other malpractices have proved irresistible. The authors express this more kindly and write of ' the difficulty of inducing society members to observe the principles of co-operation in working their societies '.

It would have been interesting to have been given the authors' views on the increasing interdependence of intensified agriculture and industrial urban development. Agriculture alone cannot sustain a population increasing at the usual rate, nor can it provide the modern complex machines and chemicals required for its own improvement.

Only a well-developed industrial system can do that; in addition, it provides work for men and women redundant on the land and markets for the farm produce to furnish the money necessary for improving agricultural methods. This theme has recently been developed by G. V. Jacks, who has pointed out some unexpected consequences.

The book evidently grew up and the passage of time necessitates certain qualifications. The statement that most tropical countries are inadequately nourished (p. 68) is apparently based on a Colonial Office report of 1939; there has certainly been improvement since then, though information is insufficient to say how much. Indians brought into Fiji to work on the sugar estates are no longer ' about equal ' to the indigenous population, but exceeded them even at the 1950 census, and the disparity is increasing, as they practically doubled in number between 1936 and 1956, while the native Fijians multiply much more slowly.

A few misprints occur in the very comprehensive bibliography, e.g. there is only one Richardson (H.L.) not two, and Gouron should be Gourou, but these are only minor slips, such as are inevitable in so large a book, and Mr. Grist is to be congratulated on having accomplished so well what must have been a very difficult task.

E. JOHN RUSSELL.

World Crop Reports

INTERNATIONAL REPORTS

Tobacco

World tobacco production dropped 4% in 1958, showing a decline for the second consecutive year. Production in 1958 was 8,269 million lb., 354 million lb. less than the 8,623 million lb. produced in 1957.

An increase of 103 million lb. in the total U.S. production, resulting from larger yields per acre, did not offset drops in other areas of the world. There were major decreases in Argentina, Colombia, France, Greece, Bulgaria, Poland, Yugoslavia, Turkey, India, Indonesia, Algeria, Nigeria, Japan, Rumania and Pakistan. In addition to the increase in the U.S. crop, other increases were registered, the more important being for Canada, Mexico, Rhodesia and Nyasaland, the Union of South Africa, Italy, South Korea and the Philippines.

North America: Production in North America was 2,229 million lb., compared with 2,106 million in 1957. The total production in the U.S.A. (November estimate) was 1,764 million lb., compared with 1,661 million in 1957. Total production in Canada was estimated at 175 million lb. – about 10 million lb. above the 1957 crop. U.S. flue-cured tobacco production was 105 million lb. above 1957 and Canada's flue-cured crop was 10 million lb. above 1957.

Europe: The total production in Western Europe was 586 million lb., or 78 million lb. below 1957. Eastern Europe's production was 975 million lb., down 132 million lb. from a year earlier.

Asia: The total tobacco production for Asia for 1958 is estimated at 3,631 million lb., down 210 million from the 3,841 million lb. produced in 1957.

South America: The total production for South America for 1958 is estimated at 473 million lb., compared with 542 million in 1957.

Africa: The 1958 production in Africa is estimated at 359 million lb., compared with 350 million in 1957. The major increases were in Rhodesia and Nyasaland, up 13.5 million lb., and the Union of South Africa.

Oceania: Production in Oceania was 16.2 million lb., compared with 14.1 million in 1957, the increase mainly due to a 2 million lb. increase in Australia's crop.

Potatoes

World 1958 potato production is estimated at 3,374.8 million cwt., 150 million cwt. or 4% below 1957. The decline is accounted for chiefly by a 5% drop in European production.

Per-acre yields of potatoes are steadily increasing in most important producing countries. Trends in recent years have been toward steadily increasing production, while acreage has decreased even more consistently. Exceptions to the increasing production trend have been attributable to adverse weather.

North America: North American crops are up 16.8 million cwt. over 1957, led by an 8% increase in the U.S.A. All countries are up except Canada, where production is down 11%.

Europe: Early estimates for the 1958 crop indicated increased production in all countries. However, excessive rain late in the season damaged crops in Ireland, England, Northern France and Belgium.*

Other areas: There are no significant changes in production in Asia or South America.

REGIONAL REPORTS

Colombia

The area planted to *cotton* in Colombia in the 1958–59 season is now estimated at 210,000 acres. This shows a steady trend upward from 155,000 acres in 1956–57 and 178,000 acres in 1957–58. The increase is a result of encouragement from the Government and the Cotton Institute in an effort to make Colombia self-sufficient in cotton.

Preliminary estimates place 1958–59 production at 135,000 bales (500 lb. gross), compared with 95,000 bales in 1957–58 and 110,000 bales in 1956–57.

To stimulate cotton production the Government pays growers high prices for seed cotton. In addition, the Cotton Institute has an extension programme to teach farmers the value of fertilisers and insecticides. Only 2 to 6% of Colombian cotton is reported to be grown under irrigation.

Colombia's cotton consumption has also increased. An estimated 175,000 bales were used in 1957–58, in comparison with 165,000 bales in 1956–57 and 158,000 bales in 1955–56. A further increase in consumption, of about 6%, is expected in 1958–59.

Cotton stocks continued at a low level during 1957–58. Stocks at the end of the season, 31 July, 1958, were estimated at 38,000 bales, compared with 47,000 bales a year earlier.

England and Wales

Conditions for cultivations during January were unfavourable and work was less forward than usual. Autumn-sown crops were fairly satisfactory.

Rain and snow fell over much of the country during the first 12 days of the month and was followed by cold, foggy weather. A thaw and general rain then gave way to colder conditions and the remainder of the month was cold and mostly dry, but with a good deal of fog, which became widespread and dense.

Conditions during the month were not favourable for cultivations and other field work and work was less forward than usual in most areas.

Wheat was fairly satisfactory, although damage by flooding or waterlogging was reported from many areas. Some damage by slugs was also reported. *Barley* looked well. *Oats* were generally satisfactory, but growth was slow in many districts. The small area of *rye* looked well. *Beans* were healthy, but again growth was slow. No serious frost damage was reported.

On the whole, *potatoes* were keeping well in clamps and stores, but some losses from wet rot were reported.

*In Europe, potatoes are generally stored in pits, and storage losses are usually heavy. This year, with potatoes containing high moisture, losses are expected to be substantial. In many countries of northern Europe only a small proportion of the total crop is used for human consumption. Major effect of the reduced crop will be smaller supplies for starch and livestock feed.

Acknowledgment is made to *For. Crops Mark.* and to *Spec. Reg. Inform. Services* for much of the information contained in the above report.

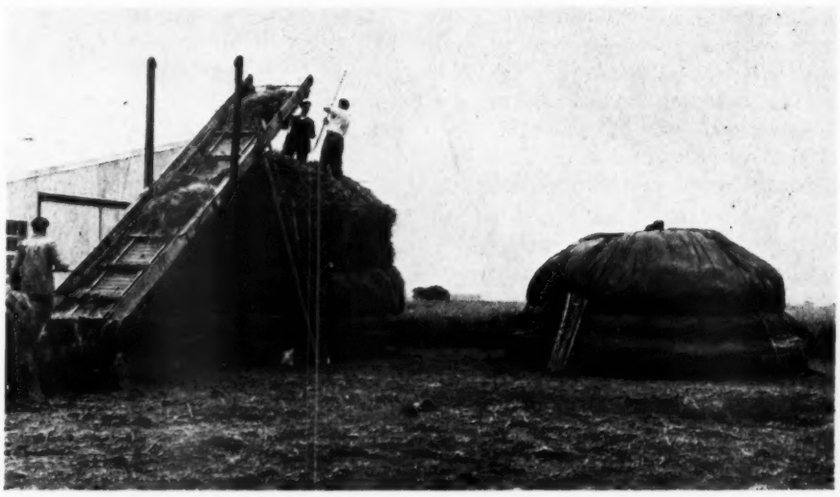
Machinery and Equipment

Twine-tying Baler

A baler of extra rugged construction has just been announced by the *International Harvester Export Co.* The new No. 46 hay baler has been tested at speeds well in excess of 10 tons of hay baled per hour, and some owners report as much as 13 tons per hour.

The extra capacity is obtained by the free-flowing design from windrow to bale, including a wide floating pick-up, a short full-floating augur and a wide-mouthed feed opening into the bale chamber. A shorter bale chamber has reduced the overall length to 17 ft. 3 in. and thus has given greater manoeuvrability. The drive is simple and direct through heavy-duty shafts with enclosed gears.

Safety devices protect the vital parts from the usual hazards of baling. A friction clutch protects against overloading and an overrunning clutch prevents shock to the drive when the tractor is throttled back. Shear bolts are located in the baler flywheel, in the drive of the packing fingers and in the needle drive. A V-belt auger drive cushions the auger against sudden shock.

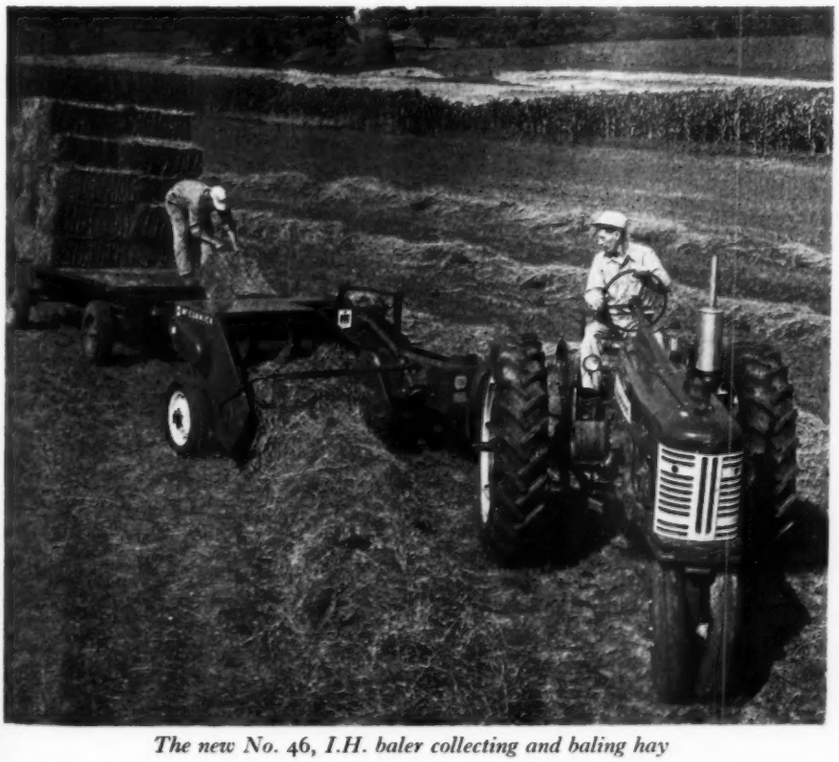


One completed ' Fablon ' silo and another under construction

A Portable Silo

The ' Fablon ' portable silo is a large plastic sleeve which is turned in at the lower end, filled up with a stack of hay, and finally sealed by drawing up the sleeve and tying its upper end, so making a completely airtight and watertight container, which ensures that fermentation takes place at the correct temperature and with the minimum loss of nutrient value.

This type of silo is easily transported and can be erected anywhere on the farm, wherever it is most convenient for feeding. The material used is a special grade of PVC sheeting, which is resistant to silage acids and will, with careful handling, last for three seasons, according to the manufacturers, *Commercial Plastics Ltd.* They are available in three sizes – 20 tons, 40 tons and 80 tons.



The new No. 46, I.H. baler collecting and baling hay

A Silage Trailer

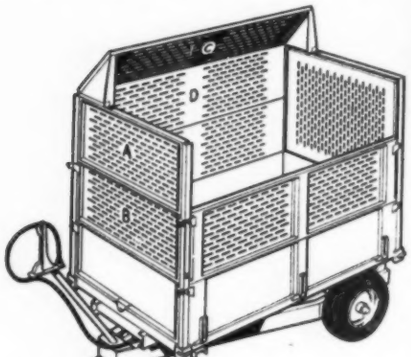
The *Markham* ' Universal ' forage trailer is primarily designed for operation with the ' Express ' forage harvester, but it is equally suitable for use with left-hand, right-hand or rear-delivery forage harvesters of other makes. The side and end sections of the trailer are removable and can be arranged according to requirements to act as baffles.

The sides are made of slotted steel and its smooth surface prevents the crop from clinging and building up on the inside and at the same time gives light but sturdy construction. It is an end-tipping, hydraulically-operated trailer, mounted on heavy-duty expansible wheels, giving from 56-in. to 62-in. wheel centres. A unique self-centring device – a quick-acting hydraulic hitch – which is fitted to the Markham forage harvester makes it possible for the trailer to be hitched up or unhitched by one man without leaving the driving seat.

The new Markham silage harvester is now fitted with a hinged chute, giving easy access to all working parts. It is a sturdy, stable and easily manoeuvrable machine with in-line operation, which enables it to be towed through narrow gateways and lanes without altering the position of the hitch.

For Forage Harvesting

With the swing towards shredded silage, the introduction of the new *Massey-Ferguson* '740' and '760' flail foragers is interesting news. The power requirements of the former are met by the '35' tractor, while the '65' matches the '760'. In both cases the speed ratios between the engine and the flail rotor have been correctly matched. The cutting cylinder operates both as a flywheel and as a fan,



The Markham 'Universal' forage trailer as arranged for right-hand delivery

and to obtain the greatest efficiency the tractor and the flail harvester need to be correctly matched, otherwise any extra horsepower could easily be wasted.

The '740' has been designed to meet the needs of farmers who want a smaller machine capable of giving high output with medium-sized tractors. It is an in-line, direct-throw machine, which follows behind the tractor. The cut is 40 in. and there is an adjustment for cutting height from ground level up to 8 in. The close coupling and easy attachment of the trailer behind this compact harvester adds to its manoeuvrability.

The 'Sprackman' pre-fabricated silage clamp is built up of 20 standard sections

This new forager can tackle short grass as well as mixed silage crops, such as kale and beet tops. With special attachments it can be used to harvest a variety of overseas crops, such as sorghum and maize. It can also be used for pulverising straw after combining and before ploughing.

For Strip Grazing

An interesting new development is the 'Yellowhammer' insulated reel, which is offered by the *Harvest Saver & Implement Co. Ltd.*, which makes it possible to move strip grazing electric fences without turning off the current and to wind up or unwind the reel to shorten or lengthen the fence or to adjust its tension while keeping the fence wire alive. Thus there is no risk of the stock breaking through while the fence is being moved and a lot of walking time is saved.

The operator releasing the 'Yellowhammer' insulated reel in order to shorten the electric fence without switching off

Silage Clamp

The 'Sprackman' prefabricated silage clamp is supplied in 20 standard sections, which are bolted together, and braced and supported in position. Each section is 3 ft. wide and 6 ft. 6 in. high and is made up of six pieces of 6-in. × 1½-in. 'Tanalised'* timber, which are bolted to a steel frame, welded in tension. Each section is self-supporting and is complete with bracing, back strut and anchor spikes.

A simple ridge roof is also available and so, when the clamp is empty of silage, it can be used as an additional portable building for storing root crops, baled hay and other bulk materials, or to make a temporary shelter for sick animals. It can provide an additional stockyard or divide an existing one to make a bull pen or a lambing fold. The sections can also be arranged as a foreloading stop, as a windbreak for wintering cattle, as a sheltering wall for milking, etc.

The Massey-Ferguson tractor fitted with the new haymaking attachment which enables the forager to be used for cutting hay

* Tanalising: The chemical treatment of timber under vacuum to prevent rot and insect damage

The new 140-bushel Oliver manure spreader and its companion the Model 89 loader

Manure Spreading

The removal of farmyard manure from stockades, yards and barns can be rapidly carried out by using a combination of the new Oliver 140-bushel, p.t.-o. spreader and its companion, the new Model 89 loader.

This spreader, the largest in the *Oliver* series, is 44½ in. high, has a capacity of 88 cu. ft. and is of sturdy plywood construction. The one-piece sides and one-piece bottom are made of ⅝-in. leak-proof marine plywood, which retains the liquid part of the manure. Metal flareboards withstand the pounding of power loaders, while a bolted, reinforced steel channel frame and heavy uprights give the new Model 470 the necessary ruggedness to keep the moving parts in correct alignment.

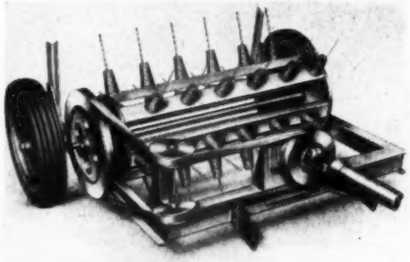
The distributor paddles are equipped with shear pins to reduce the risk of damage, and five spreading rates are provided for manure distribution.

The 15-cu. ft. capacity manure bucket of the Model 89 loader has large-diameter penetrating tines attached with a cotter to make them easily replaceable. This cotter acts as a shear pin to protect the tines and loader if ever a solid object is encountered.

Rapid Haymaking

The W1 'Wuffler' by *Bamfords Ltd.* is a hay conditioner using a new technique, which will ensure that drying is even and that haymaking can be completed in the minimum time – a great advantage when the weather is uncertain and rain threatens.

It is a wheeled trailer which is tractor drawn and p.t.-o. operated, and can be used effectively even with the tractor running in top gear. It is attached to the tractor drawbar by a clevis hitch, needing only one pin. Mechanical haymaking is effected by



The Bamford 'Wuffler' – a high-speed haymaker – with its cover and delivery doors removed to show the working parts

means of 36 sprung tines mounted on a horizontally-mounted rotating drum which is driven by a 'V' belt from the p.t.-o. of the tractor.

The unique design of the tines and the adjustable delivery doors at the rear of the machine ensure that the crop is dropped in an exceptionally light condition, so enabling the air to penetrate freely and ensure rapid drying. There is, however, no damage to the crop – no shattering of the leaf – which is thus preserved intact. The crop is delivered in neat rows, which can be moved easily by a swathe turner or collected for baling by a side rake.

A Versatile Forager

The new 'Sila-Master 40' is a rugged flail-type forage harvester primarily designed for working behind the smaller tractors on small farms, although it is rugged enough for use with the bigger power units when required.

The makers, *John Wilder Ltd.*, state that the new double-flex tines, combined with a streamlined crop-flow and minimum rotor speed, will ensure efficient delivery and excellent performance. Conversion units are available for straw cutting, mulching and vegetable waste pulverising, scrub clearance and potato haulm destruction. A two-position metal shield enables the material to be delivered either back on to the ground, or up the chute and into the following trailer.

A simple attachment to the trailer is provided by the Manners hydraulic hitch, which reduces the time taken for changing over trailers from five minutes to about 30 seconds. Even more important, instead of requiring two men, the driver does not have to get off the tractor seat and needs no assistance whatever. The 'V' guide plates on the hydraulic lift are wide

The new 40-in. flail-type 'Sila-masta' forage harvester at work behind a Fordson 'Dexta'

enough to allow for steering errors in backing, and the guide plates centre the trailer drawbar so that the drawbar ring is automatically placed over the hook, which is then lifted by hydraulic power from the tractor.

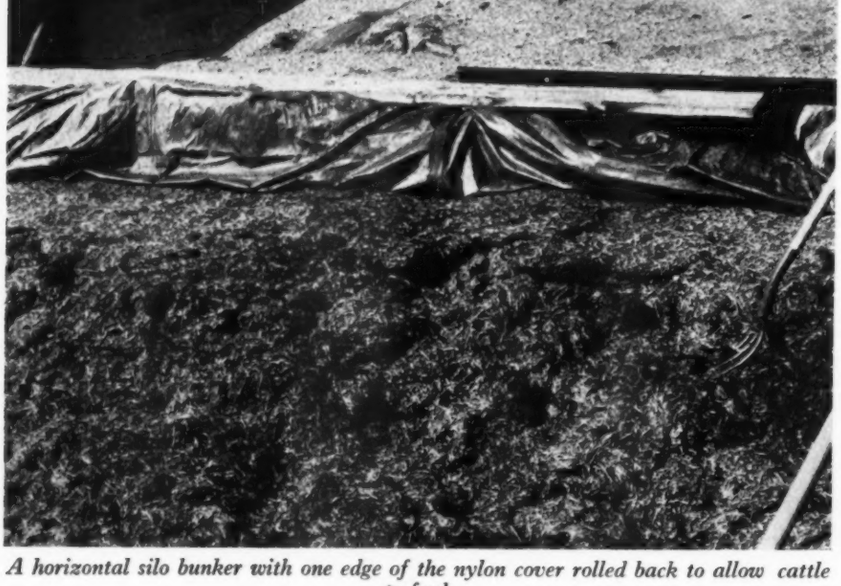
Hydraulic Silage Trailer

A useful rear-tipping, hydraulically-operated silage trailer is announced by *F. W. Petit Ltd.* It is essentially a steel mesh box, 10 ft. long × 6 ft. wide × 5 ft. in height, mounted on a sturdy chassis. The box can be upthrust by a hydraulic ram to give a tipping angle of 50° and the back section is opened by simple catches to release the load at the silage dump. The floor of the box is made of Malayan hardwood, but $\frac{1}{8}$-in. steel plate can be fitted instead, if so required.

There are three axle positions, and a special high axle can be fitted for harvesting row crops. The wheels are fitted with cone-operated brakes, operated by press button from the tractor seat, and heavy-duty tyres are fitted as standard.

A Silo of Nylon

The *Du Pont Co. of America* recommend the use of a neoprene-coated nylon fabric for the sealing of horizontal silo bunkers. The edges are weighted down with railroad ties and the top of the bunker is sealed with a 3-in. layer of sawdust. For self-feeding cattle, one edge is opened and turned back and the animals gradually advance into the bunker.



A horizontal silo bunker with one edge of the nylon cover rolled back to allow cattle to feed

Winter Haymaking

It is possible to make hay as late as October and November with the aid of the mobile *Trojan* crop conditioner. With this unit, wet grass may be dried in-barn and in-bale from, say, 50% to the normal of 15% in 10-ton lots in about 80 hours, and the resulting hay is of good quality, with no loss of starch, protein or carotin through shattering or leaching.

Whatever the weather, baled grass can be brought into the barn and stacked for drying. A tunnel – 1 ft. square – is left in the centre of each rick and the whole is covered with a tarpaulin. The ' Airator ', driven by a 10-h.p. diesel engine, forces through the stack first cold air, then warm air at 75°F, and finally hot air at 90°F. The effect of this treatment is to remove about 4 tons of water in about 80 hours.

Thus it is now possible to extend the haymaking season beyond the normal time, make good hay in adverse weather, and so supplement the winter supply of fodder.

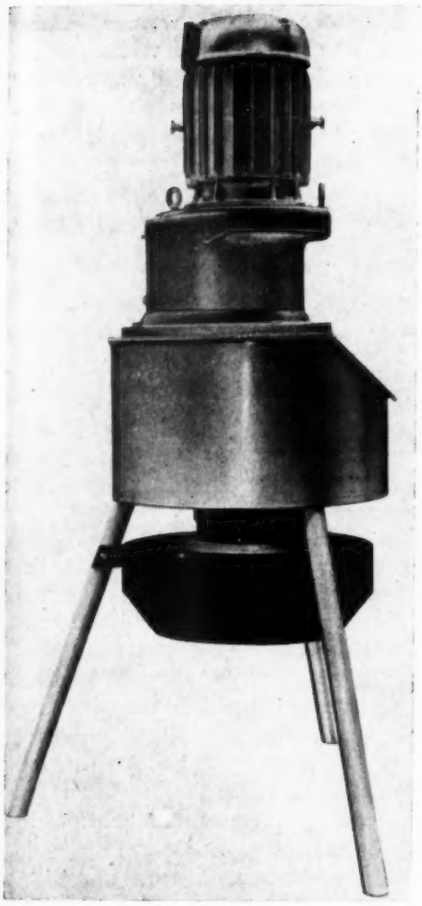
The mobile Trojan crop conditioner drying hay in-bale and in-barn in late October

A Sturdy Buckrake

The ' Maldon ' buckrake, offered by *P. J. Parmiter & Sons Ltd.*, is an exceptionally sturdy implement for collecting dried and green crops, but it needs to be stabilised to prevent side sway. It is carried in the rear of the tractor, which is reversed to collect the load on to the rake; then the tractor is driven forward and the load is deposited by a spring-loaded release mechanism, which retains the load securely even over the roughest ground.

Welding in the Field

A new welding unit by the *Lincoln Electric Co. Ltd.*, in co-operation with the *Rover Co. Ltd.*, is designed for use with the series II ' Land Rover ' diesel- or petrol-engined vehicles. This enables electric arc welding to be carried out in remote places where there are no workshop facilities. The unit is quickly detachable from the vehicle, leaving the owner free to use the ' Land Rover ' for other purposes.



The Templewood Junior provender press is a sturdy and compact machine

It thus provides, in conjunction with the 'Land Rover', a useful repair service on farm or plantation during irrigation or land clearance operations or in colonisation schemes in the rural areas, to mention only a few applications.

The L.R. 150 portable welding unit is a complete 'package' machine, with a current range of 30–200 amp., which can be connected direct to the rear p.t.-o. in place of the tailboard without any further modification to the 'Land Rover', except for the provision of an engine speed governor on the petrol-engined models. The unit is supplied complete with mounting frame and a comprehensive set of accessories to enable welding to be commenced immediately.

The machine is particularly useful to farmers and estate managers in that immediate repairs can be carried out during rush periods, *e.g.* during harvesting.

Pelleting and Cubing

With the increase in milling and mixing on the farm considerable economies can be made by cubing and pelleting farm-produced feeding stuffs to feed to stock without the unavoidable loss which is incidental to the feeding of a loose, dry meal. The pelleted product is also more easily handled, it takes up less space and no deterioration takes place.

The *Templewood* 'Junior' provender press is designed to enable farmers, pig keepers, poultry breeders and broiler producers to make a mixed feed in a readily acceptable form for their livestock. It is a cleanly-designed and compact machine with an overall height of 5 ft. 10 in., standing on three firm legs, and it can be moved easily from place to place. The machine is driven by direct drive through a gearbox by a 5-h.p. electric motor, which is mounted on top and forms an integral part of the machine.

The mixed meal is introduced into the machine through a 7-in. square opening and the flow of meal to the cubing chamber is regulated by an adjustable slide and a rotating feed plate. The pellets are cylindrical – $\frac{1}{8}$ in., $\frac{5}{32}$ in., $\frac{3}{16}$ in., $\frac{7}{32}$ in., $\frac{7}{16}$ in. or $\frac{5}{8}$ in. in diameter. They are cut to the required length by an adjustable knife.

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Under Tough Conditions

The 'Kidd Rotaflail' forage harvester is a sturdy machine which is fully offset, so that the tractor does not travel through the crop and there is complete visibility from the tractor seat during cutting and hitching. It will handle kale, chop straw after the combine and, of course, grass. With its 4-ft. cut and high speed of operation it has a production rate of up to 20 tons per hour, depending, of course, on the weight of crop per square yard of field and the type of crop. The manufacturers are the *Jeffery Engineering Co. Ltd.*

The '950' David Brown

When the tractor first replaced the horse it was a simple traction unit. Since that time there has been a continuous and incessant development of the farmer's 'maid-of-all-work', with the result that to compare the new *David Brown* '950' tractor with those early machines is like setting the latest Jaguar car against a 'turn-of-the-century' veteran car on the Le Mans circuit.

The 'Kidd' Rotoflail forage harvester seen in action in a field of kale

Powered by a new high-efficiency diesel engine developing 42 b.h.p., it has the working capacity of a big tractor, and yet it has the lower fuel consumption (under ¾ gal. per hour in normal work) of a smaller and less powerful tractor. A three-speed twin-range gearbox gives six forward and two reverse speeds. As a result, the forward speeds vary from just over ½ m.p.h. (ideal for planting operations) to more than 13 m.p.h. (for movement along roads).

The new tractor is supplied with or without ' live-drive ', according to customer's requirements. This ' live-drive ' system is operated by a single foot pedal control, which first disengages the traction clutch plate, so that the tractor stops while the p.t.-o. and the hydraulic pump drive continue to operate. Further depression of the pedal stops all movement, leaving the engine running free.

The powerful foot brakes are completely enclosed against ingress of dirt; each can be used separately to assist turning, but for movement along roads they can be linked together and used normally. A hand-operated parking brake is also provided. Both the front and the rear wheel widths are adjustable in 4-in. steps from 52 in. to 76 in., and the track widths may also be changed simply by reversing the dished wheel centres.

The rear axle houses and supports the hydraulic lift and also a new traction control unit. This T.C.U. ensures maximum wheel grip at all times without the inconvenience of using wheel weights, strakes, cage wheels or water ballast, except in the most extreme conditions. A bogged-down tractor means wasted time, and even if a complete stoppage does not occur, up to 25% of its working capacity can be lost by repeated wheel-spin. With T.C.U. this problem does not arise; by moving the lift lever into an alternative position surplus implement weight is transferred to the tractor via the hydraulic system, and this added weight turns all the engine power into pull, thus saving man-hours and fuel, and the needless tyre wear caused by wheel-slip.

The machine has a 3-point linkage, which is suitable for category 1 (light) and category 2 (heavy) implements. The top link includes an overload release, a spring-adjusted device which releases the hand clutch lever when an implement encounters an immovable obstacle. It is then only necessary to lift the implement momentarily, to re-engage the hand clutch lever and continue work.

In the special demonstration which was arranged for the Press, we were shown the easy manoeuvrability and stability of the new tractor and were allowed to try the ' 950 ' under the worst possible conditions – hard, frozen, snow-covered ground and using a variety of implements – a 2-furrow deep digger plough, a 2-furrow alternating plough and an agro-tiller. After only five minutes' instruction all were masters of the machine. Its performance, precision control, finger - light steering and driving comfort stamp it as a masterpiece of engineering design.

(*See cover illustration*)

Cultivation in Bad Weather

The value of small gardening machines as ancillary equipment on mechanised farms has been shown by two recent incidents reported by *Landmaster Ltd.*, the manufacturers of the ' Gardenmaster 80 ' rotary cultivator. On two farms it was found that, owing to bad weather, it was quite impossible to use tractors to hoe areas of sugar-beet and mangold and the job could not be left until conditions improved. Fortunately, they were both able to use their ' Gardenmasters ', thereby saving in one operation more than the cost of each machine.

The Gardenmaster being used for inter-row cultivation

The 'Auto-Drop' forage wagon - a 2-wheeled trailer of robust construction - dropping its load

The advantages of this machine for inter-row work are its small size – the overall width of the wheels is only 1 ft., and even this can be reduced to 7 in. by means of a simple conversion unit; it can also be expanded to give cutting widths of up to 24 in. The power unit is a 1.5-h.p. engine and the machine is propelled not by a drive through the wheels, but by the pulling action of the hoe blades as they move through the soil. This handy little unit can also be used for digging, weeding and ridging, for grass cutting, for hedge trimming, for sawing and for operating power tools, using the appropriate attachments.

Unloading Silage

The ' Auto-Drop ' forage wagon is a 2-wheeled trailer of sturdy construction for receiving the material discharged from the forage harvester. It is a receiving bin, constructed of heavy angle section, angle iron and sheet steel; there is an adjustable wire mesh canopy on top to permit the air to disperse, while retaining the crop. It holds up to 35 cwt. of cut grass, which is received from the harvester continuously as the crop is cut, and is discharged quite simply by pulling a wire rope, which opens the rear half of the wagon. The contents then slide out down the 40° corrugated sheeting into the clamp or silo. The keynote of this hopper is in its simplicity in design and the complete lack of moving parts. The makers are *Messrs. Silorators Ltd.*

Agricultural Chemicals

Soil Reactions

According to the agricultural newsletter of *American Medical Climax Inc.*, a recent Canadian study indicates that molybdenum, added in the form of sodium molybdate, increases yields of red clover considerably. In addition to promoting higher yields, it boosted the weights and root sizes of all legumes tested. These results are particularly significant in light of the fact that the application of 2,000 lb. of lime per acre did not have any appreciable effect. When molybdenum is bound in the soil in a form unavailable to plants, liming serves to release the element; the effectiveness of lime on these soils thus indicates an insufficiency of total molybdenum.

Effective Against Couch Grass

Under the trade name 'Weedazol', aminotriazole has proved an effective herbicide, particularly against couch grass, in U.S.A. during some five years. It is readily absorbed by the foliage and translocated throughout the plant, which becomes chlorotic and dies within a few weeks. At 4 lb. per acre, it controls couch and twitch grass without sterilising the soil or leaving harmful residues. American experience has further shown that crops such as maize, beans and cotton can safely be planted two weeks after the application of this herbicide. Pre-sowing treatment has given good weed control and no crop damage in the case of sweet corn, sorghum, wheat, beet, turnip, cucumber and soya bean. Couch grass among strawberries has also been successfully controlled.

In America a new formulation of 'Weedazol' has been found to be even more effective against stoloniferous and rhizomatous perennial grasses. 2 lb. of active aminotriazole per acre applied in this improved form to a stand of *Agropyron* in the spring, followed by ploughing 10 days later, gave excellent control – 85 to 90%. 4 lb. per acre was even better and most crops can be seeded immediately after ploughing without adverse effects, just as with the earlier formulation.

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The application of 2–4 lb. per acre to perennial grasses, without subsequent ploughing, was also very effective. 'Weedazol' has also been used in the U.S.A. in combination with other herbicides, such as monuron, simazin, trichloracetic acid and dalapon.

Similar results have recently been obtained in the U.K., where tests during 1958 have again proved that 'Weedazol' effectively controls couch grass without sterilising the soil. It has also proved effective against ryegrass, meadow grass, corn marigold, chickweed, sheeps' sorrel, spear thistle, mustard, sunspurge, dock, stinging nettle, groundsel and plantain.

'Weedazol' – originally developed and patented by the *American Chemical Paint Co.* – is now being manufactured under licence by *A. H. Marks & Co. Ltd.* in the U.K.

The Systemic Principle

Improvements in the control of agricultural insect pests during the post-war decade have been particularly noteworthy. The risks of crop failure were first reduced by the introduction of new and more potent insecticides controlling a wide range of insect pests more effectively than their predecessors, though they acted in the same manner. It was necessary to bring the insecticidal material, formulated as spray or dust, into direct contact with the insect it was intended to kill. Thereafter residues of the toxic spray continued to affect sucking and chewing insects until they were washed off or diluted by rain and dew.

The disabilities of the method are obvious. Some important insect pests are difficult to wet, others are hidden in places inaccessible to the spray, and residues remain for all too brief a period in a rainy climate. Control remained variable, since it could only be complete when all insect pests feeding on the crop received a lethal dose of the spray.

For some time now a team of research workers under Dr. Schrader, of *Farbenfabriken Bayer*, Leverkusen, had been experimenting with certain organo-phosphorous chemicals and a series of new insecticidal products has emerged. Of these, 'Metasystox', combining low mammalian toxicity in the diluted spray with exceptional insecticidal efficiency, is the best known. Its success has been due to the embodiment of the latest method insect pest control – the systemic principle.

This insecticide protects the crop by passing rapidly from the sprayed surfaces of the plant into the sap; it is then translocated throughout the whole of the plant system in quantities sufficient to kill insects sucking or mining leaves, or fruit for periods adequate to subdue and eliminate normal infestations.

Because this does not require to be timed to coincide with an insect attack, as is the case with the contact sprays, it can be applied as an 'insurance' spray when conditions might favour a build-up of harmful insect pests.

Control of aphids

In Great Britain the new insecticide has proved of immediate benefit to the sugar-beet crop, which hitherto has been particularly unpredictable in yield owing to the ravages of virus yellows. By controlling the aphid vectors of this disease, it reduced infection and assured profitable cultivation in seasons which would previously have proved catastrophic. Over the past three years it has protected some hundred thousand acres of sugar-beet in the U.K. and further millions in other countries. Its use has resulted in consistent and substantial increases in yield and sugar content in seasons when the incidence of virus yellows

is low, and has made all the difference between a profitable crop and one that is scarcely worth lifting when disease is active and widespread.

Though 'Metasystox' is derived from a group of organo-phosphorous chemicals toxic to all mammals in concentration, in the dilute form in which it is applied to the crop it has been found possible to relax the most onerous of the Poisons Regulations regarding protective clothing, and no ill effects have been reported during the whole of the period in which it has been used in Britain.

Defeating the Termite

Hitherto Nigerian Railways have always used steel sleepers because of the ever-present threat of termites and the high incidence of timber decay. Now, following the introduction of *Hickson's* 'Tanalith' C preservative and two impregnating plants, each capable of permanently preserving half a million sleepers every year, no more steel sleepers will be used.

Both of these plants are owned and operated by Nigerian Railways' personnel – one at Ebutte Metta, a suburb of Lagos, the other at Port Harcourt. Another plant is also being installed at Ibadan for the Nigerian Posts and Telecommunications. This will have a capacity of 15,000 telephone poles per year. At present these poles are made of concrete; in future Nigerian timber can be used instead.

Magnesium Deficiency

The importance of magnesium as a plant food has not been appreciated in British farming because up to now ample supplies of dung have been available. This element, however, occupies a key position in the nutrition of plants, since without it chlorophyll, the green colouring pigment in the leaves, cannot be produced – and this is only one of its functions in plant metabolism.

Magnesium deficiency can be induced by excess potassium and calcium in the soil, is often caused by unbalanced fertilising, and it can develop progressively as less and less dung becomes available owing to the declining population of farm horses, this material being rich in magnesium. Very heavy rainfall will also cause losses of this very soluble element from light sandy soils by leaching. Other factors are the use of pure potassic fertilisers and the increased arable cropping in present-day farming in Britain.

It has been estimated that the intake of magnesium by various crops is as follows: cereals, 10–20 lb. MgO per acre; hay, 20–30 lb. MgO per acre; potatoes, 20–30 lb. per acre; and sugar-beet, 50–60 lb. per acre.

The removal of these amounts of magnesium with the crops needs to be made good and it is a sign of the times that a new nitrogenous top-dressing fertiliser, combining both magnesium and nitrogen, has just been announced by the *Shell Chemical Co.* This fertiliser contains 20.5% N and 7% MgO (obtained from dolomitic limestone) and the recommendation is that it should be applied as a regular annual top-dressing at the rate of 3 cwt. per acre to replace losses through leaching and cropping.

A Living Insecticide

Thuricide is a biological pest control agent composed of living spores of the micro-organism *Bacillus thuringiensis*, and it is the first microbial agent to be produced on a large scale for the protection of food and forage crops. It is being manufactured by the *Bioferm Corporation* and marketed by the *Stauffer Chemical Co.*, both of the U.S.A.

Most modern pesticides kill insects by acting as contact or stomach poisons. Thuricide, when consumed by susceptible insects, kills through quick-acting infection, *e.g.* once the alfalfa caterpillar eats enough treated leaf to ingest 40,000 to 80,000 live spores of the bacteria it is overcome by the bacterial infection and dies. Extensive tests have established that it is specific in its action on leaf-eating insects and is harmless to humans, animals and fish. It does not harm bees, insect parasites or predators, and the indications are that insects do not develop a resistance to this microbial agent.

Among the most important applications have been for the control of the cabbage looper, imported cabbage worm, alfalfa caterpillar and the diamond-back moth larvae. It also has been used successfully against corn ear worm, cotton leaf perforator, cotton leaf roller, cotton bollworm, tobacco hornworm and tomato hornworm.

Thuricide can be applied either as a dust or spray in the same equipment and under the same conditions as for conventional insecticides. The spores are stable and do not lose potency when mixed with a variety of diluents and insecticides.

Locust Control

The chemical gamma BHC – whose value as a powerful and persistent insecticide was discovered by *Imperial Chemical Industries Ltd.* – is incorporated in a concentrated formulation – 'Agrocide 26DP' – which will control a wide range of pests on a variety of crops. It can be used as a bait, as a foliage spray, or as a soil insecticide, according to the nature of the pest.

It is mixed with bran and so used as a poison bait against locusts, *Acrididae* spp. The method of preparation is as follows: to control 1st, 2nd and 3rd instar hoppers, mix 2 oz. with 100 lb. bran; for the 4th and 5th instars, 4 oz. and even higher dosages may be needed.

The bait is scattered dry amongst the hoppers or spread in wide strips in front of, and at intervals across, the marching hopper bands. Recent work in Eastern Africa has demonstrated that the highest kills are obtained by the first method.

It can be applied either from the air or from the ground at rates from 10 lb. per acre upwards, according to the age of the hoppers, the density of the swarm and the amount of vegetation on their line of march.

The work done in Eastern Africa has also demonstrated that a given weight of poison bait will kill 30 times more 1st instar than 5th instar hoppers, which indicates that baiting should begin as early as possible.

Mushroom Spawn

Fundamental research is being carried out by Dr. R. Klein in the laboratories of *W. Darlington & Sons Ltd.* which will materially contribute to the future progress of the mushroom industry.

Strains of spawn, obtained from world-wide sources and strains, produced in their laboratories have been tested in farms on the Sussex coast, and from the three most promising they are now producing further material for larger-scale trials for testing under as varied conditions as possible.